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DYESTUFF REPORTER
DEVOTED TO TEXTILE WET-PROCESSING

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APRIL 8, 1957

AATCC Calendar

COUNCIL

June 7 (Hotel Statler, New York)

NATIONAL CONVENTIONS

Nov 14-16, 1957 (Hotel Statler, Boston); Oct 30-Nov 2, 1958 (Hotel Conrad Hilton, Chicago); 1959 (Sheraton Park and Shoreham Hotels, Washington, D C); Oct 6-8, 1960 (Sheraton Hotel, Philadelphia, Pa); 1961 (Buffalo, NY)

DELAWARE VALLEY SECTION

May 24 (Outing—Torresdale-Frankford Country Club, Philadelphia, Pa); Sept 27 (Joint meeting with New York Section at Trenton, NJ); Nov 1 (Sheraton Hotel, Philadelphia, Pa); Dec 6 (Kugler's Restaurant, Philadelphia, Pa)

HUDSON-MOHAWK SECTION

May 17 (Ladies Nite—Schuyler Meadows, Albany, NY); June 21 (Outing—Antlers Country Club, Amsterdam, NY)

MID-WEST SECTION

April 27 (Netherland Hilton Hotel, Cincinnati, O); June 14-15 (Outing—Brown's Lake Resort, Burlington, Wis); October 26 (Bismarck Hotel, Chicago, Ill)

NEW YORK SECTION

Apr 26, May 24—ladies nite (Kohler's Swiss Chalet, Rochelle Park, NJ); June (Annual Outing)

NORTHERN NEW ENGLAND SECTION

May 10 (Lowell Tech Inst, Lowell, Mass); Sept 13 (Outing—Wachusett Country Club, W Bolyston, Mass); Dec 6 (Annual meeting, Hotel Continental, Cambridge, Mass)

PIEDMONT SECTION

June 7-9 (Outing—Mayview Manor, Blowing Rock, NC); Sept 28 (Hotel Barringer, Charlotte, NC)

RHODE ISLAND SECTION

Apr 25 (Student Night—New Bedford ITT, New Bedford, Mass); June 14 (Outing—Warwick CC and Rocky Point, RI); Sept 27 (Ladies Night—Narragansett Hotel, Providence, RI); Oct 24 (Providence Engineering Society, Providence, RI); Dec 5 (Annual Meeting—Johnson's Hummocks Grill, Providence, RI)

SOUTH CENTRAL SECTION

Apr 27 (Hotel Patton, Chattanooga, Tenn); June 21-22 (Outing—Lookout Mtn, Tenn); Sept 20 (Hotel Patton)

SOUTHEASTERN SECTION

Apr 13 (Legion Hall, Lindale, Ga); June 7-9 (Outing—Radium Springs, Ga); Sept 14 (Harmony Club, Columbus, Ga); Dec 7 (Dinkler Plaza Hotel, Atlanta, Ga)

WESTERN NEW ENGLAND SECTION

May 17 (Ladies Night—Rapp's Paradise Inn, Ansonia, Conn); June 14 (Outing—Wallingford, Conn); Sept 27 (Rapp's Restaurant, Shelton, Conn); Nov 1 (Annual meeting, Hartford, Conn, area); Dec 13 (Rapp's Restaurant, Shelton, Conn)

Employment Register

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the secretary.

57-3

Education: City College, New York—liberal arts; New Bedford Textile Inst (3 years)—textile manufacturing; Philadelphia Textile Inst—woolen & worsteds; University of Pennsylvania—production engineering.

Experience: 17 years textiles, mill superintendent, manufacturing manager, sales, merchandising, styling, development, quality control director.

Age: 39; Married; References.

Position Desired: Textile manufacturing or sales, technical, administrative or executive.

Locations Desired: New York City or Carolinas preferred. Any domestic acceptable. Resume on request.

57-5

Education: Philadelphia Textile Institute.

Experience: 8 years hosiery dyeing supt. 20 years—sale of textile chemical specialties.

Age: 58; married; references

Position desired: chemical salesman.

Locations desired: New Jersey—Virginia. Any US location acceptable. Resume on request.

3-25, 4-8

57-6

Education: Brooklyn College, BA in chemistry; evening courses at Columbia, Rutgers and Boston Universities. Chemical and plastics engineering for chemicals, plastics.

Experience: 14 years.

Age: 37; married; references.

Position desired: product management; new product sales development or market development, preferably in textile chemical specialties.

Location desired: New York metropolitan area. New Jersey, Connecticut, New York state acceptable.

3-25, 4-8

57-7

Education: Washington College, BS in chemistry.

Experience: 15 years — chemical supervisor, dyehouse chemist, technical service—foreign and domestic—one company.

Age: 39; married; references.

Position desired: Supervisory, development or technical service.

Location desired: South or Southwest USA.

3-25, 4-8

Activities of the Local Sections

(L to r): PTI's Bertrand W Hayward, Martha Jungerman and Percival Theel at the March 8th meeting of the Delaware Valley Section

Delaware Valley

THE Delaware Valley Section honored the Philadelphia Textile Institute at a dinner meeting on Friday, March 8th, 1957, at the Bellevue-Stratford Hotel, Philadelphia, Pa.

Guests included PTI president, Bertrand W Hayward; Percival Theel, director of research at PTI, and Martha Jungerman, associate professor, fabrics and color.

Mr Hayward, who is completing his tenth year as administrative head of the Institute, gave the group a generalized survey of progress and developments in the other textile colleges, and in connection with his own he briefly covered the areas of research, curriculum expansion, recruiting, accreditation, success of graduates, guidance programs, students activities, athletic program, alumni fund and trustees.

He mentioned the importance to the Philadelphia Textile Institute and the other textile colleges of improving the relationship between the colleges and the textile industry. He added, "I feel that the responsibility for better textile college-industry relationship rests with the industry rather than the colleges. For us to be of the best possible service to the industry, we must have their enthusiastic support, both spiritually and materially." He lauded the AATCC for its aggressiveness in proposing a textile wet-processing career opportunities booklet and expressed the hope that it would be ready for distribution as soon as possible.

Professor Theel gave a brief history of the research program at the Institute and told the group that the present program, adopted in 1950, was set up with the following objectives: elevate educational level, active faculty participation, provide advanced training and experience, interpret fundamental research through work in applied research, conduct fundamental research, publish any and all unrestricted material to benefit the textile industry, and place the Philadelphia Textile Institute's research facilities at the industry's disposal.

He illustrated the different types of work completed or in process including: varied projects from both chemical and textile firms, projects from Government agencies, projects in cooperation with other schools and universities, cooperative fellowships with trained and technical associations and specialized technical services including spectrophotometric problems, and projects sponsored by the Textile Alliance Fund and executed by faculty members.

Miss Jungerman reported to the group the number of services that PTI is currently supplying to the textile industry in the form of the special courses. She reminded them that the Education Committee of the Delaware Valley Section had enthusiastically sponsored courses at the Institute in new developments and trends in dyes and dyeing, fabric construction, and the newest one in business principles, management and labor problems.

She also mentioned that special courses would be set up for the Philadelphia Textile Salesmen's Association, the Quartermaster, Du Pont, the knitting industry, while calling attention to the fact that a series of lectures on the latest developments in fibers and fabrics had been instituted for the Board of Education of Philadelphia. Showing the versatility of the faculty, Miss Jungerman stated that three special extension courses had been very successfully conducted with J P Stevens and Company, New York for the Stevens sales force. Other courses have benefited Chicopee Manufacturing Company and Glen Raven Mills. Miss Jungerman concluded her talk by illustrating again the interdependence of the textile colleges and the industry.

(L to r): Ernst W Empting, secretary, DVS; Clarence A Seibert, program chairman, DVS; Martha Jungerman, PTI, guest speaker; Albert E Stutzke, treasurer, DVS; and Donald W Robinson, chairman, DVS

New York

A SECOND speaker has been added to the program for the April 26th meeting of the New York Section at Kohler's Swiss Chalet, Rochelle Park, N J.

J J Iannarone, Jr, will discuss "The Dyeing of Blends of Dacron Polyester Fiber and Cotton or Rayon."

As noted previously, Raymond Thornton, Arnold, Hoffman & Co, Inc, will discuss "Procion Dyestuffs."

Western New England

A MEETING of the Western New England Section was held on Friday, March 15, 1957, at Rapp's Restaurant, Shelton, Conn.

The guest speaker of the evening was Jackson A Woodruff, head of the Dyeing and Finishing Division of the Textile Research Department of American Viscose Corporation. Mr Woodruff spoke on "Blends and Finishes Form the Future." An exhibit of many of the fabrics discussed was displayed.

Approximately 50 members and guests were present.

The site of the Section's annual Ladies Night meeting has been changed from the Waverly Inn, Cheshire, Conn, to Rapp's Paradise Inn, Ansonia, Conn. The date, May 17th, remains the same.

Perkin Centennial———

COLOR—THE CATALYST OF COMMERCE. PART II

On the afternoon of September 10, 1956, which was designated "International Day" during the Perkin Centennial celebration at the Waldorf Astoria, New York, NY, a panel of experts from many fields answered questions relative to the topic, "Color — The Catalyst of Commerce". The answers given at the time appeared in the November 5th issue of *American Dyestuff Reporter*, pages P833-P840.

Time did not allow answers to all the questions, however, and it was mentioned that those not covered would be considered and the answers published in a later issue.

Part II covers these questions and answers.

Question: What part has color played in the rapid growth of the mens sportswear industry?

Joseph Knapp (Fox-Knapp Mfg Co): I would say that color has been the most important single factor, not only in the growth of the industry but actually in the creation of the mens sportswear industry. Until we could get men to accept and to wear color, there was no mens sportswear industry. But with the introduction of color into menswear came the birth of a new industry.

Not too many years ago men considered bright colors very effeminate. . . they would certainly not even think of them as being suitable for men. With that early prejudice to overcome would you ever have predicted the tremendous popularity of pastel colors or bright reds for men?

Today, color plays an important part in every successful style item. In fact, very often our industry-wide promotions are based on color trends . . for example, the Ivy League colors of last season, or the tremendous popularity of pink, a few seasons back. Color, I would say, has *made* the mens sportswear industry.

Question: Can a style that is *not* selling well be transformed into a winner by a change in color or by the addition of new color?

Mr Knapp: For a style to be successful it must certainly be a marriage of style *and* color. There have been instances in our industry where a style has lingered for several seasons with no notable success and then suddenly blossomed out into a real winner when exciting new colors were added. We have used this same formula to add an extra season to a successful style that seemed to have just about run out of steam. By bringing out the identical item in a completely new range of colors we have added a new interest and given the consumer a new reason for liking the item. Of course there are certain styles that seem to demand a particular color, ie, staples that sell year after year in the same colors. We have found that the introduction of an exciting new color will occasionally transform a staple to a style item and increase the sale of the item considerably.

So, the answer to your question would have to be YES. . . a style that is not selling well can be stimulated into a winner by change in color or by the addition of new color.

Question: Could you give us some indication of the interest of the fabric distributor in standards of quality as they relate to color and tell us whether or not, in your opinion, there is a conflict between the rigidity standards and the flexibility of fashion?

Jackson E Spears (Burlington Industries, Inc): I have been interested in the question of quality standards simply because I am interested in the integrity of the textile business. Quality standards as they relate to textile products, despite all the complicated methods by which they are arrived at, are purely and simply definitions. In other words, my interest is in trying to arrive at the use of words to convey meanings so that the line of communication between the manufacturer and distributor on the one hand, and the consumer on the other, can be improved and reduced to understandable terms—that is, terms that both sides understand.

Now there really isn't any conflict at all between the presumed rigidity of standards and the understandable flexibility of fashion. The changing economic scene, world political developments or changes of moods, all induce people to wear one unusual color rather than another and this is not discordant with the concept that this new and unusual color should last for a little while in the garment.

Standards are not devised and should never be devised for the purpose of developing strait jackets. The purpose of standards, as I said before, is to arrive at definitions of terms and it is to encourage the quality-conscious distributor and to discourage the opportunist distributor in meeting and satisfying fashion demands without the application of such undue haste as to deliver an unsatisfactory product to a consumer entitled to receive a sound value.

A color can well be a fashionable color and still last somewhat beyond the initial wearing. And, in general, the colors of fashion are not affected by the so-called rigidity of standards. The complication in the application of standards of quality to colors arises in big categories such as lights, mediums or darks, rather than in the narrower field of color hues. In fact, one of the reasons that I have advocated the adoption of sensible minimum end-use standards is because I think that in the end not only the consumer but the industry will be well served if fashion plans the dual role of satisfying the fleeting mood with a utilitarianism that is rather the opposite of fleeting.

Good business is based upon repeat business, which is based upon confidence, which comes from the application of the simple rules of integrity.

Question: How is color used in Canadian retailing?

J W Eaton (The T Eaton Co, Ltd): Do we use color in the same degree as you do in the United States? Here I believe that the answer is "no", but a "no" of qualification rather than of straight negation. In general we tend to use rather less vivid shades and run towards softer and richer colors. Many explanations have been put forward to account for this, and many deviations from this generalization can be found without looking too far.

For example, if you look at the colors in favor outside the great metropolitan centers you find that the Quebecois prefer brighter, gayer colors than do their counterparts in Ontario and in the Maritime Provinces. The influence of the gay Coureurs de bois and the rugged early settlers is still felt by their descendants, but the Ontario and Maritimes peoples are largely of Anglo-Saxon stock from the British Isles.

Another factor may be that the

climate in Canada gives us relatively longer winters and shorter summers than prevail on the average in the United States, and thus conditions us to less vigorous colors. It is a general observation that people of tropical and near tropical countries show a greater love of brilliant colors than do those in the more northern zones.

In Canada we have a population extending almost wholly in an east to west direction. In very few places do we have population in density for more than 250 miles north to south, and in many places it is much less than this. In travelling along this "belt" we can easily run into some fairly rapid changes in color-acceptance. This does not mean that the value of color is any the less because of local, shall we say, tradition.

A common denominator of color is found in the nationally distributed brands of merchandise. Many Canadian manufacturers have made packages of their own and based their color schemes on those proven successful in the United States. The large retailers have added color and packaging experts to their own staffs, and special courses in commercial package design are now available in certain Canadian art schools. As a result of all this, the packaging and display of many private brands are quite abreast of the national brand packaging.

In the field of display, I think that we are inclined to use less vivid effects. As an example of this, most of our display materials are made in Canada of somewhat softer colors than you see in the United States. When we do buy prepared displays from this country we frequently alter them to be less startling, and yet be dramatic as a background to the merchandise. To assess the public reaction to colors, we have been using a Colour Preference Clinic, and as a guide to our buying we have developed and used extensively and successfully color co-ordinating councils for both home furnishings and fashion departments. It could be said, I think, that in Canada we are finding our own solution to the use of color in retailing and in making Canada a more pleasant and better country in which to live.

Question: You say you associate the color "red" with danger. Will a special color be used to identify radiation hazards?

Arthur S Johnson (*American Mutual Liability Insurance Co*): Red has almost universally meant "danger" and "stop". The American Standards Code Z53.1 is specific in this, and the color "red", which I described earlier[1] has made the standard "red" distinguishable by most color-blind people. Of course orange has come to be the color used to warn of less hazard than "danger", and its specific application is spelled out. With the advent of radiation hazard, which in industry is almost new, it seemed desirable at the outset to have a distinctive color that had never been used before for any single purpose. A shade of purple has been defined in the CIE chromaticity coordinates. It is unmistakably different from any other signal color and has been spelled out in the American Standard Z53.1 to define radiation hazard. It may prove to be the most important of the safety colors.

Question: What methods or techniques are used for color control in the plastics industry?

L Kenneth Merrill (*Bakelite Co*): This has been the subject of very much thought and attention in our organization. Of course, in the early days we did color matching by eye using those individuals who were proven to have a highly developed color sense. Very early we found it necessary to eliminate those few people who exhibited any tendency toward color blindness.

Late years we have pretty much standardized on spectrophotometric equipment for the charting of color values and the use of the CIE system for the definition of colors. This equipment is, of course, rather expensive and requires well-trained people for its comprehension and effectiveness. Recognizing these factors, however, we believe a satisfactory job of color measurement and definition can be achieved.

Question: What new changes are taking place in automobile colors?

Roberet Bingman (*Chrysler Corp*): I could answer this very simply by saying that there's a return to elegance underway in car colors. I might just elaborate, however. Styling, like most other things, is subject to changing phases—particularly color styling in automobiles. We are emerging from one phase now in which considerable use has been made of bright, high-chroma colors. This is as it should be.

In the post-war period there has been a steady trend to flashy, exotic colors. Out of wartime drabness came this movement and form of self-expression. The Korean war added impetus and even greater range of color selection. It seemed only natural that the consumer should express individuality in two-tone color sweeps, and even three-tone color combinations. But this trend that reveled in bright colors has produced an inevitable reaction.

The evidence is already around us. The charcoal gray to black range is starting to come back. In less than two years the demand for colors in this range has more than doubled. (Black has risen from a low point of 4.6% in 1954 to 9.5% thus far in 1956 Chrysler sales. The rise of dark gray has been more meteoric—0.3% in 1955 to 6.6% in 1956.) While gay colors still predominate percentage-wise and will continue to for some time, there is a growing preference for darker colors. It is interesting to note that almost one of every five buyers of Chrysler Corporation cars now chooses black or gray, in some combination.

This return to elegance not only means blacks and grays, but it means that most colors will be more subtle and quieter—they will be dusty or grayed-down colors. By this, I don't mean "dirty" colors. I mean clean, subdued hues with more and newer application of metallic paint. Of course there will always be an occasional bright color to serve as a complement to the others.

There are reasons, other than just color preference, that are bringing about this new trend. Body shapes are becoming more sculptured and directional. The combination of line and form, in cars like Chrysler's present "Forward Look" models, does not need the emphasis of very bright color and provides a medium on which subdued hues appear at their best advantage. As cars become more beautiful in shape and more unified in design, colors can become more subtle. The beauty and character of the car itself should predominate—not the color.

Question: Do you think that the strongly contrasting colors now being found on the American automobile forecast similar use of contrast in wearing apparel, household textiles, and perhaps in our major electrical appliances which have recently begun to appear in color other than white porcelain?

Philip M Talbott (*National Retail Dry Goods Assoc*): I am not sure that we have to follow rigidly the

(concluded on page P243)

[1] See page P836 of the November 5, 1956 issue of *Am Dyestuff Reptr.*

Committee on Damage Caused by Retained Chlorine———

REVIEW OF THE ACTIVITIES OF THE COMMITTEE—1953-1956

L L WALMSLEY, *chairman*

INTRODUCTION

DURING the past three years, the attempts of the Subcommittee on Damage Due to Retained Chlorine to construct an evaluation test have not resulted in a satisfactory test method. The tentative test does refine that in the *AATCC Technical Manual and Year Book* in respect to defining the purpose and scope and elaborating on the various phases of the test procedure. The past term's work has consisted of a series of interlaboratory tests each followed by a thorough discussion of the results obtained. Those parts of the test which were felt to have a bearing on lack of agreement between laboratories were checked and, where necessary, corrected.

It is now realized that the evaluation of damage due to retained chlorine and the development of a test method is extremely complex and cannot be solved by the procedure as outlined above. In addition, the importance of the test has grown to great proportions. This is due partly to the use of resin-treated cottons for washable wear as well as the use of synthetic fibers in conjunction with rayon, cotton, etc. Because of these developments new problems arose.

For example, a typical cotton shirting composed of both dyed and white yarns and containing no finish whatsoever was found to be chlorine retentive and did not pass the current test; that is, it did show excessive damage due to retained chlorine. This fabric has been in use for many years and, therefore, it must be assumed to be fully commercial.

There are, in addition, various fabrics which give reasonably satisfactory service, but which occasionally fail the chlorine-retention test due to some unknown reason. This is true both of home launderings and commercial launderings. Many causes, difficult to define, are responsible for this odd condition. Furthermore, it is rather difficult to prove the cause of damage in such cases. One of our more serious problems is to define what tests would be suitable for correlation with laundry practice and home laundering, and which would take into account various mishaps that occur in both types.

There is again the difficulty of separating the damage of the material due to chlorine and the damage due to retained chlorine. Account must be taken of the damage due to abrasion during the washing cycle and the variation in this respect within a normal load due to the location of the specimens.

All of these must be established before it is possible even to outline a test procedure, and after this has been resolved there comes the equally difficult work of establishing correlation between laboratories.

All of these problems have only become clear because of the great deal of work which this committee has undertaken, and it may take even years more before the problem itself is in clear perspective. The importance of this work to the textile trade cannot be overestimated and the Committee is fully cognizant of its responsibilities in this respect. The Committee, therefore, has felt that the approach to this problem must be changed. The chairman has been granted power to appoint subcommittees for the simultaneous study of the several problems which appear to have a bearing on the test.

The work of these subcommittees will be outlined by a central steering committee. The steering committee has now met and has issued its first report. As past chairman of the Committee on Chlorine Retention, the writer feels that it would be of interest to the members of AATCC to receive a comprehensive appraisal of the problems facing this Committee and suggestions for the Committee's future approach to the problem.

The following, therefore, is a brief recount of the past term's work, the steering committee's suggestion, a study of commercial laundry procedures with respect to chlorine damage, and graphs showing the comparison between commercial and home laundry conditions using varying amounts of chlorine. It should be borne in mind that, in some instances, the amount of chlorine is excessive. It is felt, however, that this should be included because the amounts of chlorine used in homes will vary to a considerable degree as well as the method of application. This may also be true in commercial practice. Therefore, the estimation of damage when using excessive amounts of chlorine could be valuable.

REVIEW OF INTERLABORATORY TESTS

A) At the October 13, 1953 meeting, the revised test procedure currently used, without certain modifications since adopted, was hammered out, and shortly thereafter adopted as the new test procedure of the Committee. This is the revised test procedure referred to as Revised Test Procedure 10/21/53. At that meeting it was decided to try out this revised test procedure in an interlaboratory test. The test fabrics used were eight cotton fabrics processed at Dan River Mills by various resin suppliers and manufacturers using various commercial treatments in an attempt to produce their best nonchlorine-retentive resin finish.

Rather poor correlation was achieved in this interlaboratory test. The best correlation on any particular sample was a spread of 20 to 48%, and the worst was a spread of 6.5 to 66% with the average sample showing a spread of 47% between laboratories.

B) At the April 29, 1954 meeting, certain changes, as a result of members' experience, were made in the Revised Test Procedure 10/21/53. These are the changes covered in L Walmsley's letter of May 12, 1954. The essence of these changes was:

1) Substitute Decersol OT for sodium laurate as the wetting agent.

2) Allow sample, after prewetting at 160°F ±5°, to cool to room temperature prior to placing in chlorination bath.

3) Standardize number of rinses after chlorination to six.

At the April 29th meeting, in view of the poor results or correlation

achieved in the initial interlaboratory test, it was decided to conduct a further interlaboratory test on three cotton fabrics supplied by Joseph Bancroft & Sons Company. These three were to include one known to be chlorine-retentive and one, not chlorine-retentive. The test procedure used on these fabrics would be the Revised Test Procedure with the changes of Walmsley's letter of May 12, 1954 incorporated.

C) This interlaboratory test was performed and reported at the meeting of June 14, 1954. Extremely poor correlation was obtained, even, in some cases, on the unfinished samples. Results on the resin-treated fabric ranged from 14 to 70% from different laboratories.

As a result of this test and a great amount of discussion on the subject of scorching as the possible key to the difficulties, a third interlaboratory test was decided upon in an attempt to pinpoint the step precluding reproducibility using the 10/21/53 revised procedure with the modifications noted previously.

For this interlaboratory test, members were supplied with swatches of cotton and rayon fabrics treated with a chlorine-retentive resin. The following procedure was followed in the interlaboratory test:

I a) All members were to chlorinate on a certain day, then send pieces to Dan River; where b) all fabrics were to be scorched at a designated time and then returned to members; when c) at a designated time, after proper conditioning, all fabrics were to be broken.

II a) Rohm & Haas Co was to chlorinate a set of rayons and cottons for all members on a certain day and send them out to members for b) scorching and breaking, after proper conditioning, at a specified time.

D) Results of this work were reported at the November 24, 1954 meeting with the following observations:

Results showed that, from the first part of the test where the resin-treated fabrics were chlorinated individually and scorched by Dan River, losses ranged from 46 to 94% among laboratories. The average was 74%. The losses on the rayon ranged from 2 to 75%, with an average of 35%.

In the second part, in which the members received the chlorinated fabrics from Rohm & Haas and then scorched and broke them individually, the losses on the cotton ranged from 76 to 89%, with an average of 82%. The rayon losses ranged from 50 to 82%, with an average of 63%.

As a result of this work, it was decided that the scorching step was not so critical as previously supposed, but rather, the chlorination and rinse steps were the most critical.

Consequently, it was decided at the November 24th meeting to run an interlaboratory test on swatches of cotton and rayon as previously used, with one member furnishing a standard hypochlorite solution to be used by all members. Samples of resin-treated (Aerotex M-3) cotton and rayon swatches were then supplied to members together with one-half gallon of a standard Clorox solution from Cluett, Peabody with the dilution specified. Members were asked to determine also: 1) pH of the rinse water, 2) pH of the chlorinating bath, and 3) pH of the unexposed portion of the scorched fabrics. In addition, a time of drying was specified, as was a time of conditioning prior to scorching.

E) The results of this interlaboratory test were submitted at the April 28, 1955 meeting of the Committee.

Results among participating laboratories showed ranges of 5 to 36% on the cotton sample and 0 to 31% on the rayon sample. Six of the participating laboratories were in the 10% range, and six in the 20 to 30% range. There was some question of the accuracy of the pH measurements, and little agreement was reached on the significance of same.

At the April 28th meeting, it was voted to repeat the test using cotton with the melamine-formaldehyde resin and to run warps only. This time, however, the samples would be randomized selvage to selvage, and yard to yard or piece to piece for different members. Also, members would be supplied with sufficient fabric to run their five tests in duplicate, once using Cluett, Peabody's NaOCl as furnished before, and repeating using their own NaOCl source. It was further decided to omit the wetting agent, Decersol OT, from the test. Members were also supplied with a form sheet for reporting numerous items, such as chlorinating data, pH's, information on scorching, rinse water, etc.

F) The results of this interlaboratory test were reported at the meeting of November 17, 1955.

At this meeting, the report of the previous interlaboratory test showed a range of 17 to 83.5% loss using local hypochlorite, and 22.5 to 81.4% loss using Cluett, Peabody hypochlorite. Nine of the twelve participating members were in the 60 to 85% loss bracket, and three of the twelve, in the 17 to 37% loss bracket, using the local hypochlorite. The pattern was much the same with the Cluett, Peabody hypochlorite; however, one of the "low" operators reported a 56% loss. In other words, the correlation again was not too good.

Inasmuch as the only change made from the previous interlaboratory test in the procedure was the omission of the wetting agent, and since members were, in the majority, now reporting losses in the 60 to 85% range as compared to the 20 to 30% range of the "high" operators of the previous test, it was felt that the only course left was to repeat the test.

Consequently, at the November 17th meeting it was voted to repeat the previous interlaboratory test with no change in procedure but with sufficient randomized fabric (viz, 5 one-yard samples rather than ½-yard samples) to be furnished to participating members so that two sets of tests, one week apart, could be performed. This was done in an attempt to see what measure of reproducibility might be obtained within the same laboratory on different days. Dan River again furnished a melamine-formaldehyde-treated cotton, and Cluett again supplied a standard Clorox solution to be used as the standard hypochlorite. A definite time was also specified after chlorination for performing the scorching, and a time was to be specified for making the tensile strength tests after scorching. Included in the questionnaire were requests for two additional values, viz, pH of the actual chlorination bath, and pH of the rinse water and last rinse before discarding. These instructions were covered in the report of December 1, 1955 sent out to members. This interlaboratory test was not completed in time for the January 19, 1956 meeting, which was given over to publication discussions and votes, but was reported and discussed at the April 23, 1956 meeting.

G) At the April 23, 1956 meeting, the results of the previous interlaboratory test were reported and discussed (report of February 1, 1956). Thirteen laboratories (12 on repeat test) participated and reported. The results of this interlaboratory test showed good correlation in any one laboratory when run on the two different days, a week apart as specified. There was also, within any one laboratory, good correlation using Cluett, Peabody hypochlorite vs local hypochlorite. However, as all previous in-

terlaboratory tests have shown, there was very poor correlation between laboratories. On the first date run—1/9/56—the results ranged from 20% to 65.1% loss using Cluett hypochlorite (19% to 66.2%, local) with five laboratories in the 20 to 30% range, three laboratories in the 30 to 40% range and the remaining five laboratories ranging from 40 to 66.2% (CP). As indicated, the results were much the same on the second date, ranging from 20% to 69% with Cluett, Peabody hypochlorite (23 to 69%, local) with three laboratories in the 20 to 30% range, four laboratories reporting in the 30 to 40% range, and five laboratories ranging from 40 to 69%.

Osborne Bacon of Du Pont, who was the "highest" operator with the 66% and 69% loss figures, presented the results of some additional work that had been done in the way of scorch test experiments in an attempt to determine how much they would have to lower their scorch temperature in order to bring their results in line with the general average. They were unsuccessful in obtaining tensile strength losses in the range of the average operator; however, the data presented showed extremely good precision using the test method at any particular temperature, and, also, a straight line graph was obtained as a result of plotting the percent strength loss against scorching temperature.

The general conclusion drawn from this interlaboratory test was that, although the method gives good reproducibility within any one laboratory, there is still some feature of the test method which precludes obtaining reproducibility between laboratories. The results of this interlaboratory test would seem to indicate that the source of the trouble is not the chlorinating or scorching steps of the procedure. Members generally agree that the rinsing step of the procedure is still a very questionable operation.

H) At the April 23, 1956 meeting, John Merrill of Cluett, Peabody presented a report of certain phases of the problem of chlorine retention wherein a study was made of the effect of various scorching temperatures and rinsing procedures. This was undertaken in an attempt to correlate the tests for chlorine retention with commercial launderings on the various fabrics used. A particular rinsing procedure, viz, that of employing N/10 ammonium hydroxide in the sixth and final rinse, apparently had the effect in this study of bringing the chlorine-retention results more closely in line with the anticipated and actual performance of commercial launderings than any other procedure. As a result of this report, it was proposed and agreed upon to conduct an interlaboratory test exploring this particular feature, viz, the use of N/10 ammonium hydroxide in the sixth and final rinse of the rinsing procedure of the test for chlorine retention.

The primary purpose of the interlaboratory test to be conducted was to see what reproducibility could be achieved between laboratories using the standard revised test method as compared with the same method employing the change in rinsing procedure. Essentially, then, it would be a study of the results obtained by six distilled water rinses vs five distilled water rinses followed by a N/10 ammonium hydroxide rinse. The various salient features of the proposed test agreed upon, covered in the instructions of May 7, 1956, are as follows:

Five ½-yard cuttings of five different fabrics would be supplied. These five fabrics would be 1) a chlorine-retentive wash-and-wear cotton; 2) a chlorine-retentive, urea-formaldehyde finished rayon; 3) a nonchlorine-retentive finished rayon—Avcoset; 4) a vat-dyed, nonresin-treated, colored-yarn cotton; and 5) a plain bleached cotton with no finish. Hypochlorite would again be furnished by Cluett, Peabody; the samples would be randomized; warps only would be run; the five fabrics would be run on five different days; a time would be specified for chlorination and for scorching; members would send swatches of their scorched and nonscorched fabrics to Du Pont, American Cyanamid, and American Viscose where chlorine analyses, alkali analyses and pH would accordingly be run.

A questionnaire would again be supplied to collect some pertinent data. At the same time, fabric would be supplied to various commercial laundries to be given cumulative white work launderings with various concentrations of available chlorine.

I) The results of this interlaboratory test were reported on at the June 14, 1956 meeting. It appeared that the test, as usual, showed complete destruction in those cases where one would expect it, and limited or no destruction in those cases where one would expect such a result. As is usually the case, it was the borderline condition that presented the problem, viz, fabric 4, the cotton shirting with both dyed and white yarns plain finished. There was a difference of opinion as to whether the results thus obtained would cause this fabric to be considered satisfactory or unsatisfactory with regard to chlorine retention. Verbal reports indicated that the reproducibility within laboratories again was quite good. However, as may be seen from the results, the correlation between laboratories again was not too good. The chlorine analyses, which were available at that time, were very inconclusive. The alkali analyses were not at that time completed, nor were any commercial laundering results.

These results have since been mailed to members on mailings of July 19—Cluett, Peabody commercial and home launderings, August 6—Consolidated commercial launderings, August 20—alkali analyses, October 23—American Institute of Laundering's commercial launderings, and October 31—tabulations of all launderings.

PRESENT STATUS

Members present at the meeting of October 26, 1956, were: R F Aurich, O C Bacon, H R Bellinson, A R Neussle, and L L Walmsley.

As a result of this meeting, it was agreed that the present status of the test for damage from chlorine retention developed by the Committee be reviewed and a task force approach be organized. It was also agreed to request that a research project be established at Lowell.

SUMMARY

A review of the situation to date reveals the following:

1) The precision within a laboratory is fairly good as shown by the latest cooperative work. See Appendix A.

2) The correlation between laboratories is poor as shown by the same tests. See Table I and Appendix B.

3) The accuracy of the average of results from all cooperating laboratories is probably fairly good as judged by correlation with laundry tests. See Appendix B.

4) The poor precision between laboratories indicates the reason for the confusion in industry using the test.

Many variables have been examined to find the reason for poor correlation between laboratories. The only factor not studied extensively is the rinse water used. Individual laboratories have reported wide variations in results with source of rinse water. It is conceivable that small amounts of organic matter or other reducing agents present in the rinse water would act as antichlors.

The amount of rinse water used is 300 times the weight of the fabric or

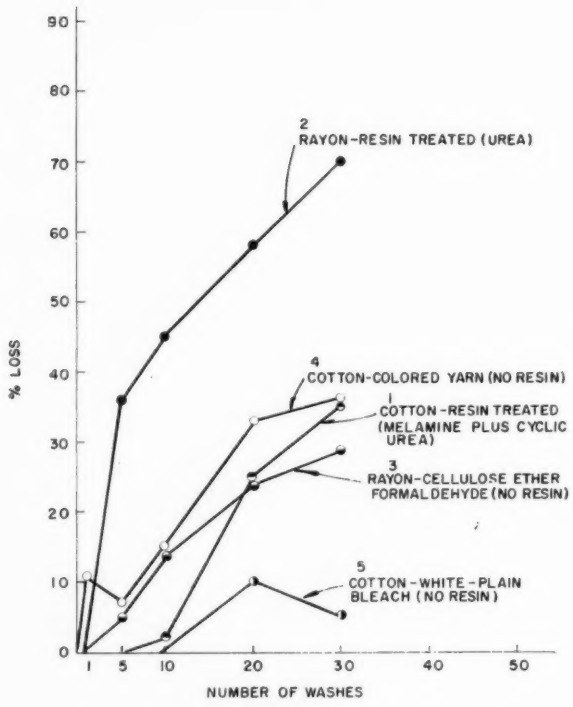
% LOSS
NUMBER OF WASHES
2 RAYON-RESIN TREATED (UREA)
4 COTTON-COLORED YARN (NO RESIN)
1 COTTON-RESIN TREATED (MELAMINE PLUS CYCLIC UREA)
3 RAYON-CELLULOSE ETHER FORMALDEHYDE (NO RESIN)
5 COTTON-WHITE-PLAIN BLEACH (NO RESIN)

Figure 1
Cluett—White commercial wash (0.01% Cl)

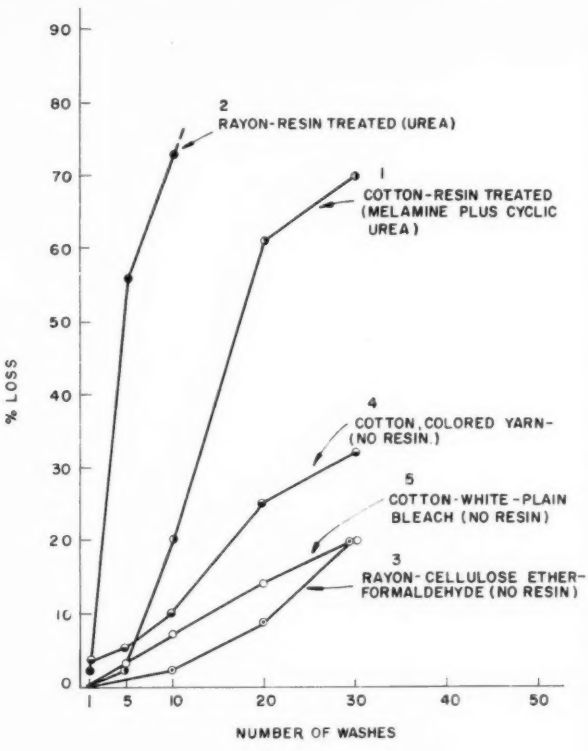
% LOSS
NUMBER OF WASHES
2 RAYON-RESIN TREATED (UREA)
1 COTTON-RESIN TREATED (MELAMINE PLUS CYCLIC UREA)
4 COTTON, COLORED YARN-(NO RESIN.)
5 COTTON-WHITE-PLAIN BLEACH (NO RESIN)
3 RAYON-CELLULOSE ETHER-FORMALDEHYDE (NO RESIN)

Figure 3
Cluett—Home-type wash (0.02% Cl)

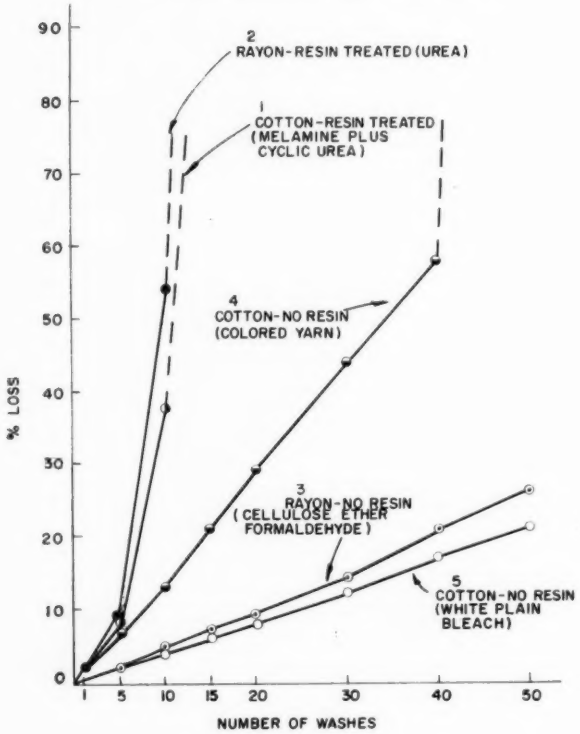
% LOSS
NUMBER OF WASHES
2 RAYON-RESIN TREATED (UREA)
1 COTTON-RESIN TREATED (MELAMINE PLUS CYCLIC UREA)
4 COTTON-NO RESIN (COLORED YARN)
3 RAYON-NO RESIN (CELLULOSE ETHER FORMALDEHYDE)
5 COTTON-NO RESIN (WHITE PLAIN BLEACH)

Figure 2
Consolidated—Commercial wash (0.015% Cl)

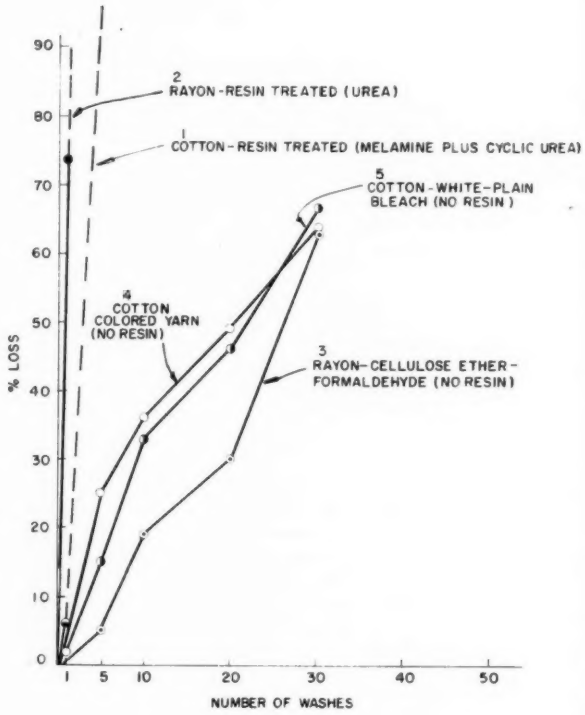
% LOSS
NUMBER OF WASHES
2 RAYON-RESIN TREATED (UREA)
1 COTTON-RESIN TREATED (MELAMINE PLUS CYCLIC UREA)
5 COTTON-WHITE-PLAIN BLEACH (NO RESIN)
4 COTTON COLORED YARN (NO RESIN)
3 RAYON-CELLULOSE ETHER-FORMALDEHYDE (NO RESIN)

Figure 4
Cluett—Home-type wash (0.08% Cl)

TABLE I
Commercial Laundering Comparisons on Committee Test Fabrics

Fabric	Laundry	Chlorine Conc (Avg Cl%)	Average Tensile Strength Loss (%) No. Washes 1	5	10	15	20	30	40	50
1	*Cluett Home Ld	.02	0.0	2.0	20.4		61.2	69.4		
Cotton, resin-treated	*Cluett Home Ld	.08	6.4	out after 4th wash						
	**Cluett Comc Ld	.01	+ 6.3	+10.4	2.1		25.0	35.4		
	***Conso Comc Ld	.01	1.5	8.0	37.5	out after 14th wash				
50% Mel	****AIL	.01	+11.9	0.0						
50% Cyclic urea	****AIL	.02	+ 2.4	+ 4.8	not completed					
	****AIL	.04	+ 2.4	7.0						
2	Cluett Home Ld	.02	1.9	55.8	73.1	out after 11th wash				
Rayon, resin-treated (UF)	Cluett Home Ld	.08	74.0	out after 4th wash						
	Cluett Comc Ld	.01	0.0	36.2	44.7		57.4	70.2		
	Conso Comc Ld	.01	2.0	9.3	54.3	out after 11th wash				
	AIL	.01	13.7	19.6						
	AIL	.02	19.6	58.9	not completed					
	AIL	.04	15.7	84.0						
3	Cluett Home Ld	.02	4.6	2.3	2.3		9.1	20.5		
Rayon (Avcoset)	Cluett Home Ld	.08	0.0	4.7	18.6		30.2	62.8		
	Cluett Comc Ld	.01	+ 2.4	4.8	14.3		23.8	28.6		
	Conso Comc Ld	.01	0.5	2.1	4.6	7.4	9.3	14.6	21.2	25.9
	AIL	.01	+ 2.3	11.9						
	AIL	.02	+ 2.3	4.6	not completed					
	AIL	.04	11.9	9.3						
4	Cluett Home Ld	.02	3.6	5.4	10.7		25.0	32.1		
96/60	Cluett Home Ld	.08	1.8	25.5	36.4		50.9	69.1		
Cotton, colored yarn, fancy, no finish	Cluett Comc Ld	.01	10.9	7.3	14.5		32.7	36.4		
	Conso Comc Ld	.01	1.5	7.3	13.3	20.7	29.2	44.1	58.6	out 42nd wash
	AIL	.01	0.0	6.0						
	AIL	.02	2.0	10.0	not completed					
	AIL	.04	+ 2.0	16.0						
5	Cluett Home Ld	.02	+ 1.2	3.5	7.0		14.0	19.8		
136/60	Cluett Home Ld	.08	+ 1.2	15.3	32.9		45.9	67.1		
Cotton broadcloth, no resin	Cluett Comc Ld	.01	+11.4	+11.4	+ 5.1		10.1	5.1		
	Conso Comc Ld	.01	0.4	2.1	4.2	6.3	8.4	12.6	16.8	21.0
	AIL	.01	1.2	+ 1.2						
	AIL	.02	1.2	9.4	not completed					
	AIL	.04	1.2	7.1						

*In Cluett, Peabody's home-type laundering, the samples were laundered in an agitator-type home washing machine utilizing the full cycle. Clorox (0.02% & 0.08% available chlorine) was added in the suds operation—using a neutral soap (Ivory) for sudsing. All samples were extracted and then pressed on a flat bed press (100 lbs approximately 320°F) and the dwell time of the press head was 28 seconds.

**Cluett, Peabody's commercial wash consisted of 4 suds and 7 rinses utilizing soap in the first 3 suds, Calgon and bleach (0.01% available chlorine) in the 4th suds with blueing and sour (zinc silicofluoride) being used in the last rinse. Suds and bleaching temperatures were 160°F. After being washed, the samples were extracted and were then pressed on a flat bed press (100 lbs approximately 320°F) and the dwell time of the press head was 28 seconds.

***Consolidated Commercial Laundry's washing procedure consisted of 3 suds and 6 rinses utilizing: a detergent auxiliary (anhydrous sodium orthosilicate) and soap in the first suds, soap in the second suds, bleach (0.01% available chlorine) in the third suds, sour (ammonium silicofluoride, 3 oz/160 gallons) in the fifth rinse, and blueing in the last rinse. The sudsing operations were carried out at 120, 140, 160°F successively, with the rinsing operations starting at 160°F and decreasing in 10°F increments with each rinse. After being washed, the samples were extracted to remove approximately 50% water, and then pressed on a flat bed press (100 lbs at 330°F) and the dwell time of the press head was exactly 30 seconds.

****The samples were laundered using American Institute of Laundering's white-work washing formula. The wash consisted of 3 suds, a bleach (0.01% available chlorine), 4 rinses, a blue, and a sour step. All steps were carried out at 160°F; except the first suds at 130°F, the last rinse at 130°F, the blueing and sour steps at 100°F, and the bleach at 150°F. The tests made at 0.02% and 0.04% available chlorine were run in a small wash wheel using dummy loads to bulk.

+Indicates gain in strength.

600,000 times the weight of chlorine when 0.05% is on the fabric, which is enough chlorine to cause damage. A very low concentration of anti-chlor would prevent damage. On the same basis, minute amounts of alkali absorbed during the rinse would neutralize HCl formed during scorching. Even distilled water, purchased in new soda glass containers, may be too alkaline. Individual laboratories have reported that the addition of acetic acid to the rinse water generally increases chlorine damage.

It is interesting to note from Figures 1-7 that, when excessive amounts of chlorine are used, damage can be disastrous even after a few launderings. There is no question that this happens occasionally, especially in home launderings. As previously mentioned this is one of the most difficult occurrences to establish.

It is also interesting to note the variations in strength losses between the various commercial laundries each using .01% chlorine, the standard amount normally used.

The graphs illustrate the same trends. For the sake of clarity it should be mentioned that when excessive amounts of chlorine are used (over .01%), as in these cases, what is also being measured is actual chlorine degradation as well as damage due to retained chlorine. This is well illustrated in Figure 4. Fabric #3, which is rayon-cellulose ether-formaldehyde, and fabric #5, which is mill-finish untreated, white cotton show high degrees of strength loss after 30 washes; and yet neither fabric is chlorine-retentive.

Figures 5, 6, and 7 are interesting in that they compare the effect of varying amounts of chlorine in commercial and home washes on one fabric. It should be noted in Figure 7 that, although a fabric made of a colored yarn (no resin finish) shows relatively high loss, the normal life expectancy of this fabric is approximately 27 launderings. The fabric, therefore, performs normally.

CONCLUSION AND ACKNOWLEDGEMENT

It is recommended that the Committee consider the proposals listed in Appendix C for action. The Committee enters its new term with every confidence that the many perplexing problems it has faced will be solved.

The author would like to express his appreciation to all of the members of the Committee for their unfailing interest and willingness to work and especially to Messrs Aurich, Bacon, Neussle, and Bellinson for supplying the data contained in this report.

Special mention should be made of the interested corporations who have given so freely of their facilities, time, and money to enable this work to be carried on.

APPENDIX A

Precision within a Laboratory

The precision of the test has been studied by one laboratory. The results are taken from 20 replicates by one operator. A normal probability distribution was obtained. The following results were obtained on a 95% assurance basis:

Number of replicates	Precision obtained
7	± 5
2	±10

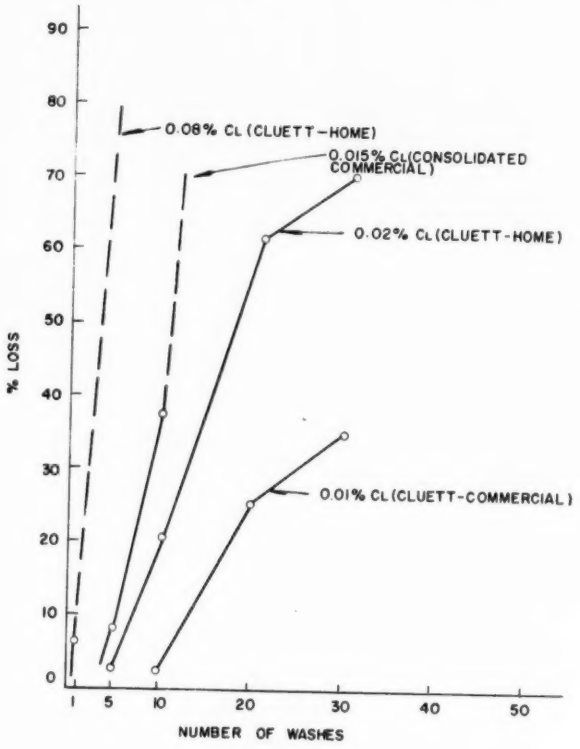

Figure 5
Fabric No. 1
Cotton—resin-treated (melamine plus cyclic urea)
Four types of washes

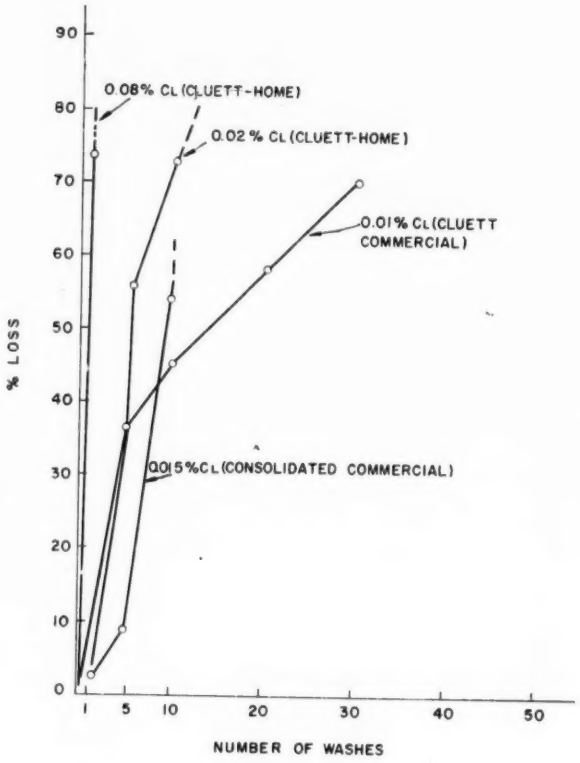

Figure 6
Fabric No. 2
Rayon—resin-treated (urea)
Four types of washes

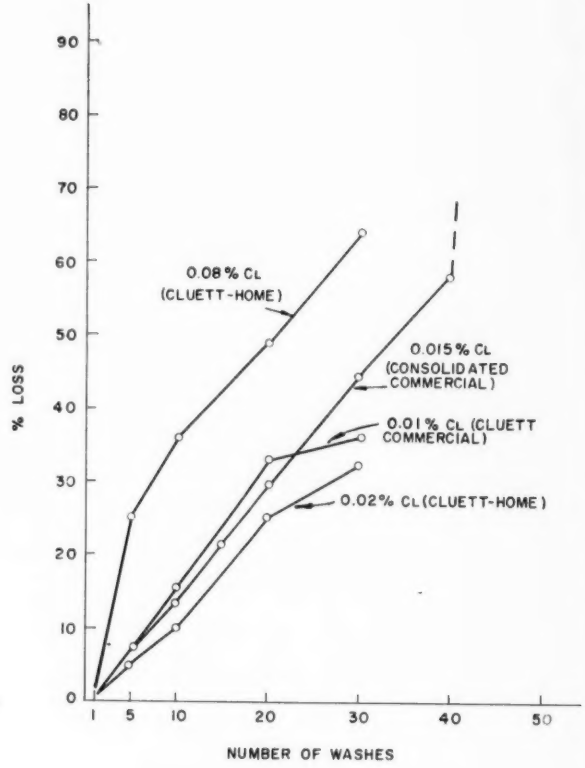

Figure 7
Fabric No. 4
Colored yarn—mill finish—no resin
Four types of washes

The
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Fabric
1) Cotton
2) Rayon
3) Rayon
4) Colore
5) Cotton

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APPENDIX B

The precision of the average of the latest committee results is as follows:

Fabric	Average % loss	Precision 68% Assurance	Precision 99% Assurance
1) Cotton—UF+MF	74	± 7	±21
2) Rayon—UF	99	± 1	± 3
3) Rayon—Avcoset	2	±10	±30
4) Colored yarn—regular	45	±13	±26
5) Cotton—untreated	5	± 5	±15

APPENDIX C

Proposals for Consideration of Chlorine Retention Committee

1) Previous interlab tests have often produced apparent discrepancies and/or raised questions on the main or side issues. Direct retests have generally not been feasible. It is proposed that, in the future, the Committee acquire the entire piece of cloth used in such tests, so that retests and further investigations can easily be made on the identical material. Acquisition of such fabric might be through gift, contribution from members, or grant from the AATCC.

2) It is proposed that a number of subcommittees or "task forces" be formed from among the Committee members. Each such subcommittee shall consist of representatives drawn from 3 or 4 laboratories, and shall be limited to a single topic for thorough exploration. Such topics might include:

a) Effects of times, temperatures, concentrations, etc.
b) Effect of differences and additives in rinse water.
c) Behavior of different types of resins and catalysts.
d) Behavior of colored-yarn, plain-finish cottons.
e) Behavior of chlorine-sensitive dyestuffs.
f) Behavior in consumer usage.
g) Revision in published procedure. Etc, etc.

These subcommittees shall prepare written reports of their tests, conclusions, and recommendations, and these shall be circulated to Committee members prior to meetings. At meetings of the entire Committee, a limited amount of time shall be allowed for discussion of each subcommittee report. Action of the entire Committee shall be limited: either to accept the subcommittee report, or to return the report to the subcommittee with recommendations for further investigation or revision.

3) It is proposed that a research project be established at Lowell, to function under the supervision or guidance of a subcommittee, with these objectives:

a) To establish equipment for performing the present test with the utmost control and reproducibility of every conceivable variable, no matter how remote or ridiculous that variable may appear.
b) To determine how reproducible the test is under such conditions.
c) To determine how variable the damage due to retained chlorine is within a piece of fabric.
d) To deliberately vary each controlled variable and determine its influence on test results.

Color———

(*concluded from page P236*)

automobile pattern of contrasting colors. This much I believe: We are entering upon an age of more and more color, and what may now strike us as bizarre and perhaps "wild" will either be toned down as we live longer with color in the future or we ourselves will become much more accustomed to it. Color is invading every field of merchandising—and rightly so. To be sure, color poses an additional merchandising problem in the form of larger inventories and this may be one of the handicaps in the more rapid use of color in department stores, but I am sure that with the proper cooperation on the part of the manufacturer the inventory problem can be solved.

Question: What is the most difficult problem for the dyestuff industry to solve?

Kenneth H Klipstein (American Cyanamid Co): Certainly one of the most difficult and important is the application of colors to a wide variety of products having entirely different uses and properties. Everyone knows that the three primary colors are red, blue and yellow. Theoretically, by mixing these three colors in varying proportions one gets any color that is desired. Therefore, it would seem that all that the color industry needs is three products which may be blended as needed by the consumer.

Why then do the color manufacturers produce literally hundreds of different compounds? The reasons for this state of affairs are actually many. For example, fabrics are constructed of many different fibers—each of different chemical constitution. Let us pick out three compounds which will dye wool in the three primary colors, and in mixtures to give the range of colors we desire. Now if we try these same compounds on cotton, we will probably find that they will not dye at all. Whereas wool will attract the dyes from solution or dispersion and the colors will remain attached to the fabric through all normal treatments, they will not color cotton at all. Therefore, our "simplest" conditions now require two reds, two blues and two yellows. Actually, because of factors such as cost, fastness requirements, shade, strength, fabric construction, dyeing conditions, end use and many others, we require many colors and formulations to fill the need. Multiply these by the number of different kinds of fibers such as rayon, silk, linen, nylon, etc, and the many other synthetic fibers which must by dyed not only in fabrics built of one fiber but in mixtures of two, three or more, and it becomes apparent that to supply the colors required by the textile industry a very wide variety of products is necessary.

The textile industry is a very large, but by no means the only, consumer of colors. Look about you. Plaster, wood, leather, paper, metals, plastics, some foods, glass—these materials are all colored either by including the color in the material or applying it in a vehicle as a surface coating. When one considers the complications mentioned before in the case of the textile industry, it is then not surprising that to color the materials mentioned pigment and dye manufacturers must make such a wide variety of products.

Perkin Centennial———

THE HISTORY OF THE DEVELOPMENT OF FAST DYES*

FRED FORDEMWALT
American Cyanamid Co
Bound Brook, NJ

In addition to being highly colored and capable of being applied to fibers, a "Fast Dye" should be chemically inert and insoluble. The natural dyes depended upon mordants to obtain insolubility. The early synthetics obtained some fastness on wool and silk by chemical reaction but required mordants for cotton. The first really fast synthetic dyes were the azoics. Several versions of these have been practical but all provide for the application of the components separately, even if in the same bath, followed by coupling within the fiber. The next, and the most valuable, group of fast colors to be developed were the vats. Solubilization is obtained by reduction, with or without esterification. After the soluble form has penetrated the fiber, the insoluble color is reformed by oxidation.

Chemical forces, such as dye-fiber salt formation with the protein fibers or hydrogen bonding in the cellulosics, generally provide less wetfastness. With some synthetics the dye, once inside the fiber, is protected from removal by the hydrophobic nature of the fiber itself. Some aspects of fastness, such as lightfastness, are poorly understood. By continued physical chemical studies of the dyeing processes we can expect a continued advance in our understanding of fastness.

INTRODUCTION

THERE are certain aspects of the nature of man which cannot be explained. They are traits with which he has been endowed by his Creator. One of these is the perception of color. Why certain electromagnetic frequencies and certain combinations of frequencies when impinging on the eye should bring to man a pleasant reaction or any reaction at all for that matter is in the end completely unexplainable. But these effects are real. We all experience them every day. They have been very real to man from the day he became a man, and life has been richer and more beautiful because of them. In all aspects of life, primitive man, like all the other animals, had to depend upon what nature gave him to supply all his wants. The love of color was embedded in his nature as deeply as in yours and mine. The blue of the sky, the red of the sunset, the green of the trees, the magnificent colors of the flowers and the birds, the riot of autumn leaves, and above all, the majestic rainbow, were here to be enjoyed from man's earliest beginnings. He himself, however, was a drab creature. From the very first, men have tried to bring some of nature's beauties to become a part of themselves. There was precious little he could do about it. He was a child of nature and was limited to what nature had to give him.

In some locations, there were pigments such as red, white, and yellow clays which could be rubbed on the body. These and such natural objects as brightly colored feathers were used to give color to the individual man's person, particularly for ceremonial occasions.

When man learned to make garments to protect himself from the wind, cold and rain, he endeavored to enrich the appearance of these by coloring them. Generation by generation he found new products of nature with which the hair and wool, and later linen and cotton could be colored. The employment of each such discovery was a cherished art. By long evolutionary processes, a fairly respectable list of natural coloring materials was found and employed.

The celebration this year is that of the preparation of the first synthetic commercial dye. This is not the centennial of the first "fast" dye. In fact, Perkin's mauve was not very fast. Many colors which had been in use from antiquity were better in this respect. Madder for red, Indigo for blue and Tyrian Purple, for example, all possessing fastness which would be considered good even by today's standards, date back to the pre-Christian era. Fabrics found in Egyptian tombs prove those ancient people too were skilled in the art of developing fast colors in fabrics. In order that we may have a clear picture of just what we are thinking about when we discuss the "history of fast dyeing," let us consider for a moment just what we mean by the words "dyeing," and "fast."

THE DYEING PROCESS———In true dyeing, the dye must penetrate into the interior of the individual fibers. In the mechanical operation of the dyeing process, the dye is brought into close contact with the surface of all the fibers whether they be in raw stock, yarn or fabric. The penetration into the fibers themselves, however, can come about only by diffusion. Essentially all practical dyeing operations are so carried out that this diffusion occurs in the presence of water. This holds for pad-steam dyeing and also for printing because in all steam-dyeing operations the dyeing occurs from the aqueous film which covers the fiber surfaces.

Only colors which are in solution can diffuse through textile fibers. Good bath circulation insures contact between dye and fiber surface but, except to maintain a concentration gradient, circulation has no effect on diffusion. Higher temperatures do increase diffusion rates and swelling agents may open the fiber structure. Both, therefore, improve penetration. Naturally any dye which can diffuse into a fiber can also diffuse out and conditions which favor one also favor the other. This is important to keep in mind when considering wetfastness.

This definition of dyeing does not include the coloring with pigments. In the case of resin-bonded pigments, the pigments are simply bound to the surface of the fibers by resins. The fastness obtained is primarily dependent upon the binders. In spun-dyed material the pigment colorants are embedded in the inside of individual fibers by being mixed in the dope from which the fibers are spun. It is recognized that such methods have been developed to a high degree during the past twenty years and excellent results for many uses are now possible. These processes do not involve dye fastness in the sense usually implied, however, and since the discussion must be limited to a relatively small part of the dyeing field anyway they will not be discussed further.

FASTNESS———Turning now to fastness, we may begin by a quotation from the *Encyclopedia Britannica*.

Dyeing is defined as "the art of colouring textile and other materials in such a way that the colour appears to be a property of the dyed material and

*Presented on September 13, 1956 during the Perkin Centennial celebration at the Waldorf-Astoria, New York, NY

not a superficial effect such as that produced by painting. The result of a dyeing operation may be regarded as satisfactory and the substance can be truly termed dyed when the colour is not removed by rubbing or washing or by the action of light. Comparatively few colours pass all tests to these influences; other types of fastness such as resistance to perspiration, street mud, bleaching and finishing are frequently required——."

This statement expresses what is meant by a "fast color."

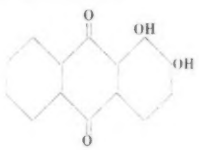
In all consideration of fastness, it is important to keep in mind that no group of colors either on the basis of chemical composition or method of application will consist entirely of "fast" colors. Among the poorer colors there are some which have good fastness to one or more tests, while, even among the vat dyes some examples of poor fastness are encountered. As familiar examples, we have the many direct cotton dyes which have poor fastness to washing but which are quite fast to light. It is also commonly recognized that vat dyes having outstanding fastness on cotton and rayon may fade rapidly when on nylon. The factors involved in fastness are extremely complex and involve the fibers and the conditions as well as the dyes themselves.

The consideration of fastness can be simplified by dividing into but three categories: 1—washfastness, 2—fastness to rubbing (crock fastness), and 3—all others.

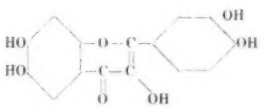
WASHFASTNESS BY INSOLUBILITY———Washfastness is related primarily to the difficulty of diffusing the color out from the interior of thoroughly wet-out dyed fibers. The most successful method of obtaining washfastness is by the deposition of insoluble colorants inside the individual textile fibers.

Water readily penetrates all hydrophilic fibers, such as the cellulose and animal fibers. Along with the water only those materials which are in solution can pass through, however. Insoluble colorants inside the fiber are unaffected by water and are extremely fast to washing. Since an insoluble material can no more diffuse into a textile fiber than it can diffuse out, special methods are required to get them on the inside. The fastest dyes, therefore, are those which can be applied in a soluble form but can be insolubilized inside the fiber after uniform penetration has been obtained. Some interesting exceptions exist with new hydrophobic fibers where insolubility is of less importance once the dye has penetrated to the inside of the fibers. In these cases, the extremely hydrophobic nature of fibers themselves protects the color from being removed.

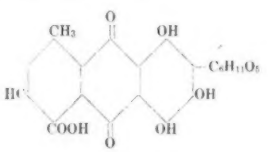
Many of the ancient natural dyes, such as madder, fustic, cochineal and logwood, obtained insolubility by combinations of soluble colorants with mordants such as aluminum or tin. These dyes all contained hydroxyl or carboxyl groups and were good lake formers. The essential material of madder was alizarine.



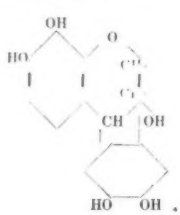
Old fustic contained tetrahydroxy flavanol:



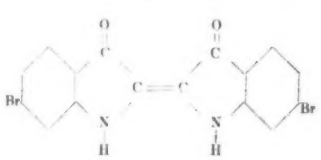
Cochineal contained a highly substituted anthraquinone:



and the essential component of logwood was hematoxylin:



Indigo and Tyrian Purple, however, were in themselves insoluble and depended upon a reduction process to convert them to a soluble form for application. After the soluble form had penetrated the fibers, the insoluble colorant was regenerated in situ.



Tyrian Purple. (The unbrominated compound is indigo.)

WASHFASTNESS BY CHEMICAL COMBINATION ——— Water-soluble dyes are readily removed from the interior of the hydrophilic fibers unless they are held in place by chemical forces. As a result, their fastness to washing is apt to be poor. When the chemical forces involved are sufficiently strong, however, the color may have rather good fastness. The indefinite word "affinity" has long been used to describe the extent to which the dye is taken up and retained by the fiber. Since the forces involved are chemical, the chemical nature of both the dye and the fiber is involved. With the animal fibers, salt linkages with either the amino or carboxyl groups can be utilized.

In the case of the cellulosic textile materials, no such chemically reactive groups are present. The most available type of combination of fibers with dyes is that of hydrogen bonding. Vickerstaff has shown that published values of heats of dyeing for direct dyes are in line with those expected from one or more hydrogen bonds. Free energies of dyeing determined by Peters and also by Woerner for leuco vats fall in the range to be expected from such forces. Since these bonds are relatively weak, soluble dyes alone do not give good wetfastness on cellulosic fibers.

It should be stated that one of the most important recent advances in the dyes field has been the application of physical-chemical methods. As illustrated by the use of thermodynamic methods to measure affinities, such studies have already shown considerable promise in clarifying the factors involved in fastness.

Conceivably, an excellent fast dyeing of cellulose could result by linking the color to the fiber by an ester linkage on the hydroxyl or by a grafting reaction on an active hydrogen. Thus far, however, such possibilities are not encouraged either by the chemical nature of the known kinds of coloring materials or by the known conditions of such reactions. A first requirement in any dyeing process is that the fiber itself must not be altered to diminish its value for textile uses. Therefore, since cellulose is a relatively fragile polymer, drastic reaction conditions are not tolerable.

FASTNESS TO RUBBING——— Fastness to rubbing, or crock fastness, depends upon the amount of dye deposited on the surface, ie, the amount of unpenetrated dye. The dye which has penetrated the fibers will not crock. In many commercial processes it is quite difficult to prevent

some dye from becoming entrapped in the interstices of the yarn or fabric but only superficially deposited on the fiber surfaces. This will rub off. If its deposition cannot be prevented, an adequate scouring is required.

OTHER FASTNESS PROPERTIES ———For the most part other fastness properties, including lightfastness, depend upon chemical inertness. They are, therefore, grouped together. It should be kept in mind that some of these, like lightfastness, are of great importance.

In the course of normal usage, a dyed fabric is exposed to hot solutions of soaps and alkalies, chlorine, perspiration, a wide range of both oxidizing and reducing atmospheric gases and to sunlight. Resistance to all of these conditions requires a high degree of chemical inertness. Stability to many of them is simply the result of specific chemical properties and is inherently connected with the chemical nature of the dye. Lightfastness, however, is more obscure. The type of fiber and the environment have as much to do with the lightfastness as the properties of the dye itself. The fading reaction is evidently chemical and is initiated by the absorbed light energy, probably through intermediate free radical formation. Therefore, chemical inertness is important. The knowledge of lightfastness remains empirical and based on experience rather than theory. An illuminating study of the entire area of lightfastness would do much to advance the development of faster colors. The science of dyeing has many years of improvement ahead, however, before it will be possible to tell the fastness of a dye by any other method than the routine testing now commonly adopted.

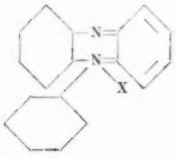
HISTORICAL DEVELOPMENT OF SYNTHETIC DYES

While man has been able to dye his textile material for over two thousand years, he has been able to synthesize his own colors for the relatively short time of one hundred years. The growth of the dye industry has come about along with the growth of organic chemistry. It seems it might be of interest for the purpose of a "History of the Development of Fast Dyes" to trace the history of the beginnings of some of the different classes of synthetic colors. In doing this, the dyes will first be considered in groups based on their chemical nature and then in groups based on their application properties. No pretense is made of making the discussion all inclusive, an impossible task both in terms of allowable space and availability of facts. There are important groups which have been omitted entirely.

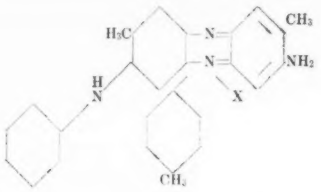
The graphic presentations of the discovery of dyes in the different classes are carried only through the year 1910 to provide a picture of their development from a historical point of view. The numbers used were obtained from the old *Colour Index* and from available portions of the new *Index*. Although no data since 1910 have been included, it should be remembered that the activity in the dyes field has been continuous. The graphs are presented to show only the earlier historical development. They provide no indication of the discoveries of the past few decades. The dyes field is still one of the most challenging and most active of all the areas of the organic chemical industries. With the increase in the volume of synthetic fibers and a better understanding of the science as well as the art of dyeing, a steady flow of newer and better products and processes can be expected in the years ahead.

Chemical Nature

AZINE DYES———The characteristic configuration of the azine dyes is:



A wide range of compounds has been built on this structure by the substitution of different groups on the rings. These include Toluylene Blue, discovered in 1879, and Induline Scarlet, in 1892. Most are basic in nature because of the quaternary nitrogen and many also contain basic amino groups on the rings. Azine acid dyes are made by the introduction of one or more sulfonic acid groups. The azines can be dyed directly onto the protein fibers but do not dye cellulose effectively except when a mordant is present in the fiber. As a rule they do not possess great fastness. The Nigrosines and Aniline Black, in which the azine bridge is probably repeated several times in a single molecule, are of considerable commercial interest. Historically, the azines are of interest because Perkin's Mauve was probably the azine:



The general quality of these dyes has not been such as to stimulate great interest in them. As shown in Figure 1, the greatest activity seems to have been shown in the last twenty years of the last century. It was during this period that the studies of Witt, Nietzki, O Fischer and others combined to explain their constitution and formation.

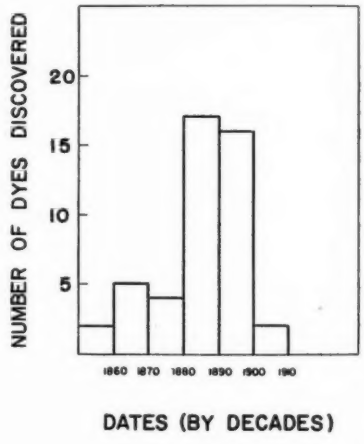
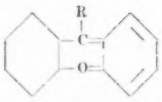


Figure 1
Azine dyes to 1910 by dates of discovery. Total number of dyes included—46.

XANTHENE DYES———The xanthene structure:



has been the framework on which has been built a series of interesting colors including the brilliant Rhodamines. The first members were the phthaleins prepared by Adolf von Baeyer in 1871. The colors may be acidic or basic in nature depending on the substituent groups present. They generally dye onto the amino or the carboxyl groups in animal fibers directly but require mordants for cotton. The fastness is generally poor, particularly to light. Most of the xanthene colors were developed over fifty years ago. The period of activity in these dyes is shown in Figure 2.

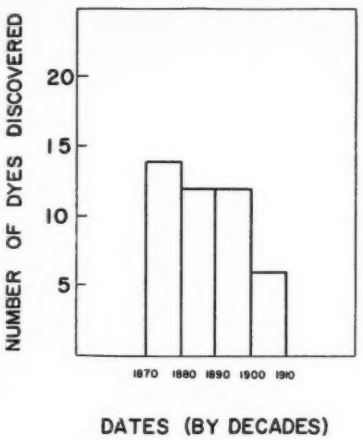


Figure 2

Xanthine dyes to 1910 by dates of discovery. Total number of dyes included—44.

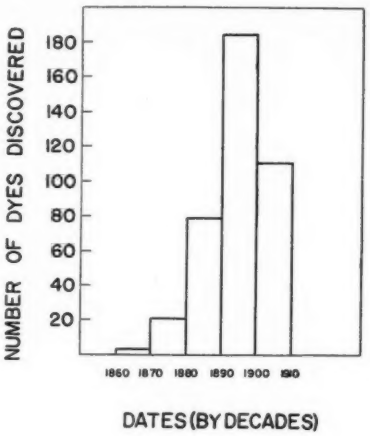


Figure 3

Azo dyes to 1910 by dates of discovery. Total number of dyes included—396.

AZO DYES——The discovery of the diazo reaction in 1858 by Griess provided the dye chemist with one of his most fruitful synthetic tools. The essential structure is the azo bridge:

$$-N=N-,$$

which may be repeated two or three or even four times in a single molecule. The chemical nature of the dye is determined by the nature of the substituent groups present. Great versatility in chemical properties is possible in the azos because of the potentially almost limitless arrangements of substituents. Most contain water solubilizing sulfonic acid groups. Such water-soluble colors are anionic in nature and thus can react with the amino groups to form a salt type of linkage with animal fibers. This provides some measure of fastness to water. They have no corresponding reactivity with cellulose. However, as was first discovered with Congo Red in 1884, many are directly applicable to cellulose in spite of this. This applicability to cotton, never adequately understood, has no doubt been an important factor in the extensive development of the azo dyes. These colors being soluble and also incapable of forming strong chemical bonds with cellulose generally do not have good wet fastness. The principal source of affinity is probably hydrogen bonding between active sites on the dye and the hydroxyl groups of the cellulose.

The historical development of the azo dyes is shown in Figure 3. Although no data since 1910 have been plotted this is still an active field.

Without solubilizing groups, the azo compounds are insoluble and in fact many excellent pigments belong to this class. About 1880, as a result of the work of Holliday and Thomas in England and Graessler in Germany, it was discovered that it was not necessary to complete the formation of the azo dye before applying it to the fiber. Instead, the diazotized amine and the coupling component were applied separately and permitted to couple inside the fiber. Since both coupling components were soluble, but the final coupled dye was insoluble, this fulfilled one of the requirements of fastness, the deposition of an insoluble colorant in the interior of the fibers. Many ramifications of this method have been developed such as the *ice colors* and *fast color salts* on Naphthol prepares and the Rapidogens. The introduction of the Naphthol AS series in 1912 expanded the range of colors and also provided even improved fastness. Since dyeing conditions generally make it possible for some coupling to occur outside the fibers to deposit dye on the surface, good crock fastness is sometimes difficult to obtain.

ANTHRAQUINONE DYES——The anthraquinone nucleus:

has provided the foundation for some of our fastest synthetic colors. Significantly it will be recalled that some of the fastest natural colors such as madder and cochineal were anthraquinone derivatives. Since chemical inertness is important to fastness, the great chemical stability of anthraquinone makes it an excellent intermediate on which to build fast dyes. Depending upon the nature of the substituent groups, the anthraquinones may be acid, mordant, or disperse dyes. The vattability of the nucleus itself makes many anthraquinones excellent vat colors. The early history of the utilization of the anthraquinone nucleus in dye manufacture is shown in Figure 4. The activity in this area has been continuous up to the present although it is doubtful if any other period has approached that from 1900 to 1910 in the number of new dyes discovered.

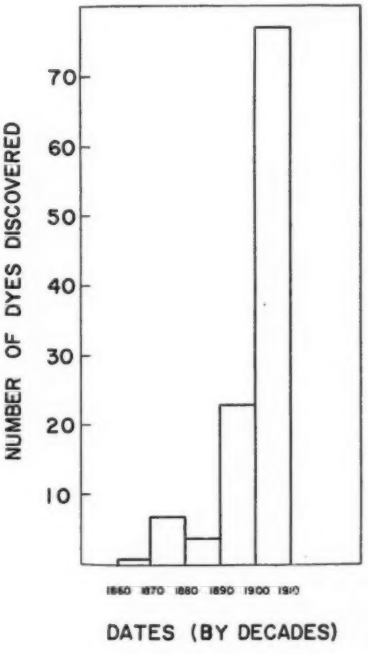
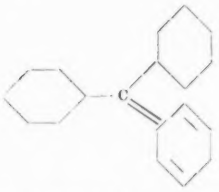


Figure 4

Anthraquinone dyes to 1910 by dates of discovery. Total number of dyes included—112.

TRIPHENYLMETHANE AND DIPHENYLNAPHTHYLMETHANE DYES——Among the methane dyes, we find some of our very commonly encountered colors, such as Alkali Blue, discovered in 1862, Methyl Violet, in 1866, and Fuchsine, in 1859. There are two points of historical interest in these colors. They were among the first classes of colors to be synthesized and they were sufficiently superior to Perkin's first dye to cut short the reign of Mauve. Also,

much of the first synthetic dye industry in America was built around these dyes. Based on a methane nucleus:



these dyes are either acidic or basic in nature depending on the substituents introduced. They are generally applicable to animal fibers but can be dyed on cotton only with suitable mordants. Their fastness is generally only fair. Their early development is shown on Figure 5.

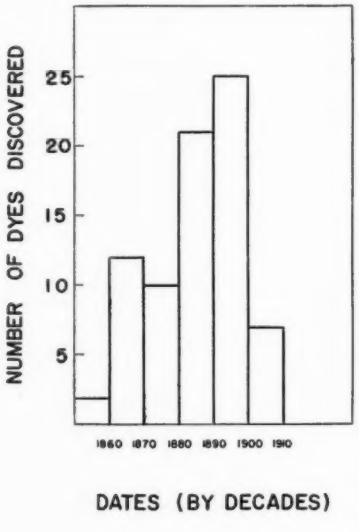


Figure 5
Methane dyes to 1910 by dates of discovery. Total number of dyes included—77.

Having considered some of the more important classes of dyes from the standpoint of their chemical nature, we may now turn to the historical development of some dyes grouped according to their application properties.

Application Properties

MORDANT DYES——Mordant dyes are soluble colors which have no particular affinity in themselves but are capable of forming insoluble salts or lakes with suitable mordants. Since these lakes are often quite stable and quite insoluble, many mordant colors are extremely fast. The ability to form lakes is built into the molecules in different ways although the use of carboxyl and hydroxyl groups is most common. In all cases, the soluble colorant and the soluble mordant are applied separately. Each when alone penetrates the individual fibers. When the mordant is applied first followed by the dye, the two react inside the fiber to form the insoluble colored lake *in situ*. The natural dyes madder (alizarine), fustic, and cochineal, whose structures were presented earlier, are excellent mordant dyes. Different chemical classes of colorants are used for mordant colors although many of the best are anthraquinone compounds. The carboxyl and hydroxyl groups are acidic in nature and the most commonly used mordants are metal salts. The final lake is a complex metal salt of the dye and the exact color depends upon the metal used.

The historical development of mordant dyes to 1910 is shown in Figure 6. There has been continued activity, however, and many of the dyes discovered since that date would be classed as mordant colors.

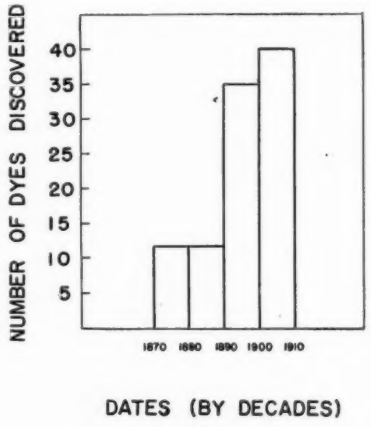


Figure 6
Mordant dyes to 1910 by dates of discovery. Total number of dyes included—99.

SULFUR COLORS——The first sulfur color was Cachou de Laval made in 1873 by heating sawdust, sulfur, and caustic soda.

The sulfur colors represent a group of dyes applied primarily to cellulose in the form of compounds soluble in solutions of sodium sulfide. After the application of the soluble dye, a highly insoluble form is regenerated inside the fiber by oxidation. In their application properties, the sulfurs most closely resemble the vats. Due to the insolubility of the oxidized form, the wetfastness is excellent. The stability to other influences, particularly chlorine, is apt to be poor and the range of shades is somewhat limited. Figure 7 shows there was great activity in sulfur colors around the turn of the century. To a much lesser degree interest has continued to the present time.

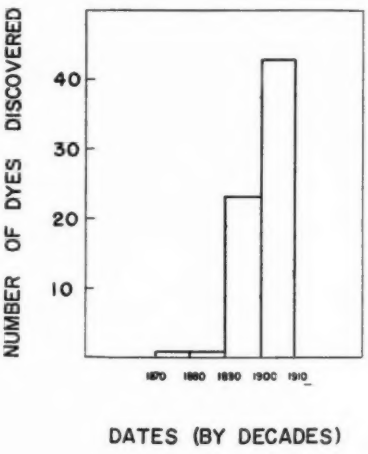


Figure 7
Sulfur colors to 1910 by dates of discovery. Total number of dyes included—58.

DIRECT DYES——The direct dyes may be considered to have begun with Congo Red in 1884. They have one real virtue, ie, simplicity of application. The term "direct" in this case means the dyes are applicable directly to cotton without the use of mordants or chemical reactions. Many have excellent chemical stability and are quite fast to light. None used alone without extra treatment have good wet fastness. This, as discussed earlier, is a consequence of their water solubility and the weakness of any chemical forces which exist between the dyes and the fiber. The directs form a large group of dyes and still find large usage where outstanding fastness is not required. Several resin and metal aftertreatments produce marked improvements particularly in the wetfastness of some of these colors. There is, however, a distinct need for direct dyes of improved over-all fastness properties.

Chemically different classes of colors are represented although the azos, particularly disazos containing the benzidine nucleus, predominate. The historical development of the direct dyes through 1910 is shown in Figure 8. There has continued to be continued considerable interest in

dyes of this kind since that date and it is to be hoped that new and improved direct dyes will be found.

ACID DYES———The acid dyes are made up of colors which are applicable to wool or other protein materials from acid baths. They are all anionic in nature and all have acidic groups, general sulfonic acid groups, in the molecule. They are water-soluble and depend upon the reaction with the amino groups to obtain fastness to water. The azo dyes make up the largest number for any chemical group. In the case of certain structures, the fastness can be improved by the use of metals, particularly chromium, in the bath. Hydroxyl groups ortho to the azo bridge favor the formation of chromium complexes. These generally have greater stability and less solubility than the unmetallized dye and, therefore, the chromation improves the fastness.

The historical development of the acid colors to 1910 is shown in Figure 9. Interest in dyes of this general classification is still high, and many valuable colors have been developed in the past few decades.

VAT DYES———By far the outstanding colors in the field of fast dyes are the vats. They possess the qualities of chemical inertness and insolubility to an outstanding degree. They generally fall into two chemical classes, the indigoids and the anthraquinones. The ancient dyes Indigo and Tyrian Purple are indigoids. In application, all are alike in that a reduced form is soluble and can be applied so that penetration of all fibers is obtained. Then by a reoxidation treatment, the colored, inert, insoluble dye is regenerated inside the fibers. The result is a coloration generally as permanent as the fiber itself.

The synthetic vat dyes industry did not develop until after 1900. Their great value was quickly apparent, however, and by 1910 about 100 different vats had been discovered. Activity in the vat dye field has been continuous. The period from 1920 to 1930 was particularly fruitful with such developments as Jade Green in 1920, Yellow GK in 1922, Golden Yellow RK in 1924 and Scarlet 4G in 1927. In addition there was the entirely new development of the soluble leuco esters of the vat dyes by Bader in 1921. The announcement on June 18, 1956 of the formation of the "Vat Dye Institute" is a significant indication that there will be continued activity in the vat dye field.

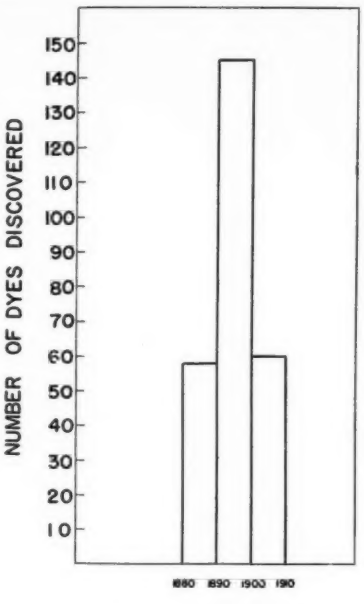


Figure 8
Direct dyes to 1910 by dates of discovery. Total number of dyes included—263.

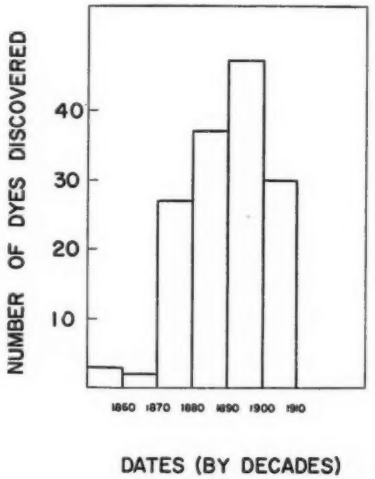


Figure 9
Acid dyes to 1910 by dates of discovery. Total number of dyes included—146.

AMERICAN DYE INDUSTRY

In America the synthetic dyes industry probably started between 1860 and 1865 with a plant to manufacture the basic dye fuchsine in Brooklyn. At the institution of the German chemist, August Partz, a plant was built on Gowanus Creek, to make the dye from imported intermediates. Whether or not it ever made any dye is not known. However, Thomas Holliday began the manufacture of Magenta in Brooklyn in 1864. Arthur Botts also began making Magenta in Albany in 1868. Friedrich Bayer acquired an interest in the Albany factory and sent Hermann Preiss from Germany to take charge of production. With the protection of a 50¢ per pound specific and a 35% *ad valorem* tariff, the business prospered. However, no mention seems to have been made of American coal-tar dyes at the Philadelphia Centennial in 1876 although 160 specimens of German manufacture were on exhibit.

A small scale struggling dye industry held on with many reshufflings of ownership and mixtures of successes and failures. Operations were scattered from the New York area to as far west as Parkersburg, West Virginia.

A private report to Professor Schultz published in the edition of 1882 stated that there existed two coal-tar dyestuff factories in America, both in the State of New York. One had a daily production of 450 pounds of scarlet, brown, Chrysoidine, violet and orange. The other produced 12,000 pounds of Fuchsine and 5,000 pounds of blue and violet per month. By the year 1890, Eosin, Safranine, Erythrosine, Rose Bengale, Rosaniline Blues, Nigrosine, Induline, Chrysoidine, Bismark Brown, had been put into production by the Heller & Merz Company in Newark and Orange II was in process. There were no American-made dyes on exhibit at the Columbian Exhibition in Chicago in 1893, however. Professor Otto N Witt, an official German observer at the exposition, reported "the coal-tar industry of the United States is unimportant and will remain so until the Americans overcome their prejudice against byproduct coke. Meanwhile, the United States will continue to be an excellent market for coal-tar products of all kinds—the few coal-tar dye factories in America are small and unimportant, and are not able to supply more than a very small fraction of the domestic demand for these products. The major portion of these products will continue to be imported from Europe, principally from Germany."

He was right. No serious dye industry existed in this country until its development was forced upon us by the exigencies of World War I. The growth of the manufacture of fast dyes in America dates from that period. Now, one hundred years after the discovery of the first synthetic commercial dye, the dyes field, both in Europe and in America, remains one of the more vigorously expanding areas of scientific investigation.

Perkin Centennial———

MODERN TEXTILE DYEING TECHNIQUES*

P L MEUNIER

E I du Pont de Nemours & Co, Inc, Wilmington, Del

The development of improved methods of dyeing natural and man-made fibers is discussed with particular reference to continuous operations for the large volume of natural fibers and high temperature dyeing methods for the newer synthetic fibers.

The more important modern continuous dyeing machines, Pad-Steam, Williams unit, Bond machine, and the Thermosol method for dyeing synthetic fibers and their blends are described. Batch dyeing procedures particularly for the new synthetic fibers also are included, such as high temperature dyeing of yarns, rawstock, tow, etc, in circulating machines and the Barotor and Burlington pressure machines for piece goods.

INTRODUCTION

IN this year of the Perkin Centennial we are honoring the man whose discovery of the first synthetic dye began an era which will stand in history as having a most profound effect on scientific progress. The story of the developmentof coal-tar dyes and other products through chemical research over a hundred years, as it has been unfolded before this convention, is indeed impressive.

If this is a matter for thoughtful consideration, then there is still another which deserves full attention. This same era will be remembered for the remarkable and far-reaching changes that have taken place in the bleaching, dyeing, printing and finishing of textiles. It has been said that a hundred years is not a long time in the history of the textile industry, yet longer periods in earlier centuries have passed without bringing any great changes. New and spectacular industries have risen since 1856 and most of them now in the limelight are less than fifty years old. If one is primarily concerned with change, then the textile industry ranks high in the list of the large industries that have undergone almost complete revolution since Perkin's time.

Synthetic dyes have replaced almost all of the natural dyes. Compressive shrinkage, organic chemical finishing agents, particularly resins and water-repellent treatments, have revolutionized finishing and the new man-made fibers, rayon, acetate, regenerated protein and the remarkable all-synthetic fibers have completely changed the character of the textile coloration and finishing industry. It is not our purpose to review in detail any of these phases but to chart the development of modern dyeing techniques.

The textile industry has been accused even in the recent past of adhering to antiquated methods of dyeing despite the fact that real progress has been made in research into the mechanism of dyeing and in the development of modern continuous methods of dyeing and printing. Such criticisms are usually leveled by those who have little knowledge of the industry and its problems. Obviously this is a matter of education. Some experienced dyers still refer to dyeings as "dips" when preparing samples for customer approval, leading many to believe that dyeing is a matter of immersing the textile material in a dyebath, squeezing and drying. Nothing could be further from reality especially in these times when mixed fiber fabrics are so often encountered.

It is true that basic mechanical principles of dyeing and printing have not undergone great change but very important improvements have come through the application of chemistry and physics to the problems of production in the textile mills.

Although this is the occasion to honor Perkin for the synthesis of the first man-made dye, later discoveries in the vat-color series are more important to the progress of textile dyeing. Indanthrene, synthesized by Bohn in 1901, and the subsequent development of a complete range of dyes gave impetus to application research directed toward continuous operations. Improvement in vatting procedures for indigo and the discovery of sodium hydrosulfite and the sulfoxylates (*1*) contributed greatly to the modern dyeing processes.

There is no question that vat dyes are the most important class of products for the mass markets of cotton and rayon fabrics as we know them today. They satisfy the high standards of quality demanded by the consumer because of their excellent fastness to washing, light and the various color-destructive influences encountered during the life of garments.

It is equally certain that the application of vat dyes was a serious challenge to dyers at the turn of the century when only indigo was used to dye rawstock and chain warps. Dyeing of direct colors and the mordant dyes was relatively easy compared with the complicated methods of reducing vat dyes, applying to cellulosic fibers and then oxidizing to "trap" the original chemical form of the vat dyes within these fibers. It was particularly difficult to dye piece goods to give smooth dyeings with all the fastness properties inherent in these remarkable colored molecules.

TECHNOLOGY OF DYEING WITH VAT COLORS

Modern dyeing and printing techniques really began in the early years of this century when the textile industry came into its own as one of the largest in the world. Cotton was then, as now, the large volume fiber. As the man-made fibers, viscose rayon and cellulose acetate, gained their positions in the textile picture at the expense of cotton, the mercerizing process, calendering and other methods of producing attractive fabrics with good color and fastness, helped cotton maintain its superior position. All the while the consumer was learning to discern the differences between good and bad fabric characteristics, particularly in regard to fastness of dyeings.

Prior to 1920, the major portion of vat dyeing was carried out by the jig-reduced method. In this procedure, the dye was reduced with caustic soda and sodium hydrosulfite and the cloth was passed back and forth through the "vat" on the jig and the absorbed dye was oxidized on the jig in a separate bath containing chemical oxidizing agents, such as sodium perborate. This method produced desirable color effects, but on tightly woven goods the dyeings were often lacking in "cover" or lev-

*Presented on September 13, 1956 during the Perkin Centennial celebration at the Waldorf-Astoria, New York, NY.

NOTE: Duponol, Dacron and Orlon are registered trademarks of E I du Pont de Nemours & Co, Inc

elness and penetration. It is a relatively expensive batch process and is seldom used except for light shades on loose constructions.

In 1908, the pigment pad-jig-reduction process was first described (*2*). This is a two-step batch method which yields dyeings of the highest quality but at high cost of labor. In the padding process the cloth is immersed in a finely dispersed aqueous suspension of the vat dye pigment, then it is squeezed. The cloth may be dried or batched on a roll while wet and then the dyeing developed by reduction and oxidation on the jig. As in any batch process, there are variations in shade from batch to batch and there is the further disadvantage in spoilage of goods at each end of the roll of cloth.

CONTINUOUS METHODS OF DYEING

Continuous methods of dyeing with vat colors have always been sought to reduce the cost of application and to produce uniformly dyed goods from beginning to end of the run. To do this while maintaining attractive appearance and good fastness properties on all types of fabrics was indeed a real challenge.

Early attempts to accomplish these objectives were only partially successful. The reduced pad-"booster" or liquid phase development system (*3*) has been used for dyeing very long yardages in which labor costs are low compared with jig dyeing. Successful operation depends on careful control of color and chemical concentrations in the "booster baths." The depth of shade is severely limited by the solubility of reduced color or leuco vat dyes. "Booster" boxes usually hold about 1,200 gallons of liquor, requiring substantial amounts of color and chemicals. Long runs, therefore, are needed for economical operation. In regard to quality of dyeings, the penetration and fastness properties are satisfactory for many fabrics but, in general, they are inferior to dyeings made by the pigment pad-jig reduced method.

Another continuous process, the pigment pad-"booster" development method, yielded improved dyeings. However, except for the fact that pigment padding allows the application of heavy shades, this process has the same major disadvantages of the reduced pad-"booster" system; requiring large development baths, long yardages for economical operation and relatively slow establishment of uniform shade.

The soluble vat dyes, which are sulfuric acid esters of the leuco compounds, since their discovery in the 1920's have been used widely for continuous dyeing of light or pastel shades on cellulosic fibers. These dyes are applied by padding along with sodium nitrite, and then the fabric is run through a sulfuric acid bath to effect oxidation and fixation of the dye. Soluble vat dyes have little affinity for cellulosic fibers. Consequently, the concentration of dye in the padding liquor changes very little and shade control is relatively easy. However, their high cost and lack of substantivity limit their use to pastel shades.

MODERN CONTINUOUS DYEING TECHNIQUES

Research on high-speed continuous dyeing during World War II resulted in outstanding advances over the established methods. On the theory that rate of reaction increases rapidly with increasing temperature, three typical methods were developed, each having its particular merit.

1) Pigment Pad—Continuous Reduction in Hot Boosters

2) Pigment Pad—Continuous Reduction in Williams Unit

3) Pigment Pad—Chemical Pad—Steam Process

The basic principle involved in all these processes is that treatment of pigment-padded fabrics in reducing media at temperatures much higher than those used in conventional vat dyeing brings about very rapid reduction and absorption by the cloth. In fact, the time for fixation is now measured in seconds instead of many minutes usually required in conventional processes.

The first process (*4, 5*) consists of padding on a dispersion of unreduced dye, drying or partially drying and subjecting the padded cloth to an alkaline reducing solution at 180-212°F, said solution containing a small amount of dye to compensate for color bleeding off the fabric while in this solution. Rinsing, oxidizing and soaping are carried out in the usual manner. In subjecting padded cloth to the hot reducing solution, a three-roll padder can be used or, for higher speeds, one or more "boosters" in tandem with the padder may be required to give adequate immersion time. It can be seen, however, that this method calls for considerable skill and experience when dealing with compound formulas since the concentrations of dye components in the reduction bath are seldom the same as those in the pigment pad because of differences in their rates of exhaustion. The process is designed for long runs and is not as versatile as others because dyes in the reduction bath are subjected to destructive conditions for longer times, speed of the two padders must be uniform and liquor level automatically controlled. Moreover, the concentrations of caustic and hydrosulfite in the reduction baths must be controlled through frequent titrations.

The second process, Pigment Pad—Continuous Reduction in Williams Unit (*6, 7*) follows the same procedure as above except that the Williams Unit offers an ideal system for liquid phase reductions at high temperatures (200-212°F). The Williams Unit is a steam-heated tank with compartments or wells in which the annular spaces are limited by insertion of baffles. Thus, the fabric passes through a series of narrow channels spaced to a point which produces the most effective dyeing action.

A single Williams Unit in connection with a padder can be used for the reduction and dyeing of many fabrics and shades. For the highest reduction speeds, using vat dyes which require maximum reduction time, two units may be piped together and used in series. Following reduction the fabrics are rinsed, oxidized, rinsed and soaped in the usual manner.

Although the Williams Unit has advantages over "booster" boxes in reduced pad-reduction processes, its chief use is in pigment-pad operations, where the cloth may be predried or entered wet into the unit in which very rapid reduction and fixation of the vat colors is accomplished at high running speeds. Of course, success of the operation depends upon manipulation and control of the high-temperature reduction bath in the unit. On many fabrics such as drills, twills, poplins, gabardines and ducks, satisfactory dyed appearance is obtained only when the pigment-padded cloth is dried before reduction. Much closer control of the reduction bath is possible when entering dry material because replacement of liquor in the unit is taken care of by the normal absorption of the dry fabric. As a result, so-called "equilibrium" conditions are maintained easily by keeping constant liquor level by feeding a reducing solution containing a small amount of the pigment-padding composition.

The use of Williams Units in the continuous method described and in certain modified procedures has been

widespread in the industry. Very good quality of dyeing is obtained on a variety of cotton fabrics and viscose rayon materials and blends of these fibers. The unit has also been used for developing vat dyes in hot mineral oil (*8*).

Ideal conditions for applying vat dyes require placing the unreduced vat color pigment where it is intended to be and then reducing it and developing in that position. This is best exemplified by the Du Pont pad-steam continuous process (*9*). It consists of padding fabric with the vat color pigment, drying under controlled conditions and then impregnating the padded material with a solution of caustic soda and sodium hydrosulfite followed immediately by steaming to effect reduction and fixation of the reduced dye. Such treatment was first considered highly unorthodox and dangerous because it subjected the vat dyes, known for their sensitivity to over-reduction, and hydrolysis with alkali at high temperatures, to extremely rigorous conditions. But it was easily demonstrated that dyeing in this manner was not harmful since the reduction and fixation processes take place so rapidly that the dye molecules per se are not affected. Even the least stable types exemplified by the chlorine fast indanthrone blues are degraded only to a minor extent. It is believed that these surprising results, recognized after painstaking work in this field, have begun a new era in vat dye application. Undoubtedly the dyes are protected from chemical degradation by the cellulosic fiber on which they are absorbed so readily in the pad-steam process.

The basic method has several distinct advantages over other procedures. These are

1) There is no practical limit on the range of shades which can be applied.

2) Continuous dyeing is made practical for short yardages, 3—5,000 yards, whereas the other processes require longer runs for economical operation.

3) Quality of dyeing is equal or superior to that of the pigment pad-jig reduction method.

4) Control of shade from beginning to end of run is simplified.

5) Vat dyes with different dyeing properties, ie, cold dyeing and hot dyeing types, can be applied together.

6) Since reduction and fixation of color are brought about in a steam phase, excellent union dyeings are obtained on cotton and rayon mixed-fiber fabrics.

7) Dyes sensitive to high-temperature reduction baths can be used safely in the pad-steam method.

Through a simple modification of the basic process, eg, by elimination of the drying step after padding, a wide range of unmercerized fabrics, certain pile and napped fabrics and terry towling are dyed commercially. Other modifications include reduced padding with vat or sulfur colors followed by steaming, reduced pad-steam and liquid booster (inside the steamer) and the vat acid-pad-chemical pad-steam process. The reduced pad-steam method is used for light shades on fabrics containing vat-dyed yarns, clip dots, effect yarns or for overdyeing of vat-color prints. The next modification which uses a liquid booster bath in the steamer is used chiefly for dyeing rayon/acetate mixed fiber goods. The booster is made up with hydrosulfite, soda ash and common salt, thus reducing the alkalinity of the padded fabric and leaving the acetate white. The vat acid-pad-chemical pad-steam method is limited to light and medium shades because of its dependence on solubility of the leuco vat dyes but very good levelness and solidity of dyeing are obtained. Vat-acid dispersions are used in this manner for lightweight cotton and spun rayon fabrics.

STANDFAST PROCESS———This method of continuous dyeing with vat colors has recently been introduced in England (*10*). It consists of impregnating the cloth by passing it downward through a solution of reduced vat dye in caustic and hydrosulfite on the surface of a molten metal bath at 205°F. The molten metal is contained in a "U"-tube with the dyebath on the surface at the entering arm and a solution of Glauber's salt on the surface of the metal at the exit arm. Dye liquor is stored as stock vat in separate steel tanks and is pumped through a preheater to the dyebath arm of the "U"-tube. Depth of the dyebath is about eight inches and the volume is about one gallon. Temperature of the bath is maintained at about 165°F.

This is essentially a reduced pad operation, the metal expressing to about 140% liquor retention. After passing through the salt bath on the delivery end, the material is ready for washing, oxidizing and final soaping processes.

Thus far only limited commercial use of the Standfast process has been made in this country. In England a wide variety of the so-called soft goods, such as drapery cloth, and unmercerized cotton fabrics have been dyed in volume. Prepadding with pigment vat colors is required for good penetration and level dyeing of tightly constructed, mercerized cottons, such as poplins, gabardines and twills.

The Standfast method has several apparent advantages as follows:

1) Continuous operation and lower labor costs.

2) Rapid cleaning of the dyebath when changing shades, as little as three minutes.

3) Ease of duplicating shades from run to run.

4) Control of shading from selvage to selvage and end to end.

5) Vat dyes which usually require varying amounts of caustic and hydrosulfite can be dyed with the same quantities of these chemicals, thus allowing the use of combinations not applicable in other methods of dyeing.

BOND MACHINE (*11*)———This is an interesting development in dyeing with vat colors that employs perforated plates between which the fabric passes, beneath the surface of the dyebath. Dye liquor or vat dye pigment dispersion is pumped at high velocity through the perforations onto and through the fabric from each side of the cloth. The machine has not yet attained commercial importance but it is reported that level impregnation of material is accomplished.

OTHER DEVELOPMENTS

In other fields of vat-dyeing research, practical processes have been developed for dyeing cotton knit goods in overhead reel machines and cotton hosiery in rotary machines. Special methods are available also for dyeing animal fibers, acetate and the newer synthetic fibers. A large segment of the textile industry employs vat colors for dyeing cotton yarns in package and beam machines which use the principle of circulation of dye liquor through the textile material. Cotton rawstock is dyed in similar equipment. In all of these processes the application of chemical and engineering principles has been indispensable to the development of efficient methods.

While the emphasis has been given to vat dyes, it should be mentioned that continuous, more economical processes have also been developed for the application of direct, sulfur and azoic dyes to cotton and rayon fabrics. The pad-steam process and

the Williams Units have been particularly successful in these applications. The Pad-Roll dyeing system (*12*) is a new procedure now in use in Europe for applying substantive dyes. It is a high-production, low-cost method in which dyes are padded on the fabric, which is then passed into a conditioning chamber and batched on a roll. Continuous dyeing methods for wool have been devised for the application of indigo (*13*), acid and premetalized neutral-dyeing acid colors (*14*).

There are many other examples of progress in dyeing which cannot be considered here. It should be enough to say that the textile industry has demonstrated its dynamic character and that new methods based on improvements in quality of work and cost reduction will always receive careful attention.

SYNTHETIC FIBERS

Another serious challenge met by the textile industry is that concerned with man-made fibers and, particularly, synthetic fibers. The progress of rayon and acetate in all types of wearing apparel has been no less than phenomenal, but this has not happened overnight, nor has the development of spinning, weaving and dyeing technology been without its headaches and heartbreak. Most of us recall vividly the struggle to dye rayon fabrics without streaks, wagon tracks and barré. Also, promotion of acetate depended largely on the synthesis of a new line of colors, the disperse dyes, and even these leave something to be desired in regard to fastness to gas-fume fading, washing and sublimation. Nevertheless these fibers today are prominent members of the family of textiles through which the industry continues to make notable progress.

Nylon is classified here as the first truly synthetic fiber. Although its place in our picture was practically assured by the almost complete replacement of silk in women's hosiery, where the disperse dyes perform adequately at conventional dyeing temperatures, the advent of nylon actually caused a further change in textile dyeing practices. Military requirements for shades with improved fastness to washing and light focused attention on the acid, metalized acid, chrome and vat dyes. It was quickly established that the hydrophobic nature of the fiber could not allow easy access of such dyes which are absorbed with facility on hydrophilic fibers like cotton and wool. Dyeing assistants or swelling agents, such as formic acid, phenol, salicylic acid, benzoic acid, have their effect at conventional dyeing temperatures in the range of 160-200°F, but the most important influence is temperature increase. As in the case of vat dyeing of cotton, temperature rise causes a manifold increase in dyeing rate and diffusion rate. This effect is the theme of dyeing the hydrophobic synthetic fibers. It applies to all of the newer fibers. We will review these developments in this light.

NYLON———The basic problem in dyeing fabrics made of nylon filament is that yarn or fabric irregularities are often accentuated in the dyed state. These irregularities may be of one or more of the following types:

1) Luster differences in yarn which lead to streaky appearance even when the yarn bundles are uniformly dyed.

2) Physical variations in adjacent yarns of the fabric, such as might be introduced during processing of yarn to knitted or woven fabrics.

3) Chemical differences typified by variations in the basicity of individual yarns.

Whereas disperse dyes cover physical and chemical irregularities because they transfer readily during dyeing, luster differences persist as streaks. Acid dyes, on the other hand, not only fail to cover but actually accentuate physical and chemical variations in conventional dyeing processes. These dyes are absorbed on nylon by salt formation of the dye anions with terminal amine end groups in the fiber. At temperatures under the boil there is little if any migration or transfer of dye. Consequently many dyeings with anionic colors on nylon fabrics are streaky because the rate of dyeing is influenced strongly by small differences in chemical affinity and crystallinity of the individual yarns.

It has been recognized for some years that some improvement in transfer and levelness of nylon dyeings with selected colors is effected simply by dyeing in aqueous baths at elevated temperatures and super atmospheric pressures. Although this treatment undoubtedly causes some swelling of the yarns and further swelling can be obtained by the use of chemical swelling agents, the improvements in levelness are not of sufficient magnitude.

Recent studies have demonstrated that greatly improved levelness in a wide range of shades can be obtained with acid colors by dyeing at 235°—250°F in the presence of a long-chain fatty alcohol sulfate, such as Duponol D Paste (*15*). This surface-active agent apparently competes with the anionic dyes for dyeing sites in the fiber, minimizes the tendency of dyes to strike unlevelly and it markedly increases transfer or levelling of the dyes. Commercial application of this method has resulted in level dyeing of nylon tricot knit fabrics and certain lightweight woven constructions.

Continuous dyeing of nylon yarns and fabrics with acid and disperse colors by a pad-steam process and continuous methods for nylon staple have been demonstrated (*16, 17*). These procedures use steam at atmospheric pressure or aqueous baths at temperatures near the boil to attain quick absorption of dyes. In the case of pad-steam dyeing of nylon fabrics, practical success has not materialized because there is no levelling effect to cover fabric irregularities and dyeings are often unlevel despite the fact that dyes are fixed substantially where they are placed on the material.

High-temperature dyeing of nylon yarns in pressurized package dyeing machines at 250°F has been practiced commercially for a number of years. Selection of acid dyes for this purpose gives adequate levelness for the end-use requirements.

DACRON POLYESTER FIBER ———The advantages of high-temperature dyeing for Dacron staple, spun and filament yarns, fabrics of 100% Dacron and blends with other fibers have been thoroughly publicized (*18, 19, 20, 21*).

In aqueous dyebaths at temperatures at or slightly under the boil carriers are required to assist absorption and diffusion of disperse dyes into this fiber. We are all familiar with the tremendous effort expended in devising the commercial dyeing processes in use today and the outstanding success of the whole enterprise. There is hardly any development in our history which approaches this one as an example of cooperation between dye research chemist, application research chemist, engineer, and textile mill management. The industry has quickly learned and applied the relatively new principles of dyeing this hydrophobic fiber. Manipulation of baths involving sensitive emulsions, suspensions and solutions of carriers, the behavior of disperse dyes in the presence of such exotic chemical compounds and the control and design of equipment to maintain the highest possible temperatures at nor-

mal pressures—all of these factors had to be mastered. Yet our troubles are not over. Cost of dyeing is high and there are still some limitations in fastness properties imposed by the use of certain carriers.

Two alternative processes for Dacron and its blends are gaining favor steadily.

First is high-temperature dyeing up to 250°F in aqueous baths in pressurized equipment. Loose fibers and yarns are handled relatively easily in the adaptable package and rawstock machines. Piece goods are dyed in pressurized jig, Barotor and Burlington Hy-Press machines. The prime advantages of high-temperature dyeings are

a) Carriers can be eliminated or greatly reduced in concentration, thus saving a great deal in direct cost and time and labor.

b) Dyeing cycles are reduced sharply.

c) Dyeing efficiency is improved substantially.

The second alternative method is Thermosol (*22, 23*) dyeing, which consists of padding fabrics with disperse dyes, drying and then subjecting the padded fabric to high temperature in the range of 390 to 450°F for about one minute. Thermosol is an apt name for the process which probably causes disperse dyes to become fluid and dissolve or diffuse into the fiber plasticized at the high temperature. The process is particularly useful on blends of spun fibers which can be padded uniformly and dried without migration of the disperse dyes. Outstanding examples are the blends of Dacron and cotton or rayon (*24*). After Thermosol treatment with disperse colors and/or selected vat dye pigments, the cellulosic component is dyed with vat colors to give products having remarkably good fastness properties.

ACRYLIC FIBERS———In a few short years, Orlon acrylic fiber staple has reached full stature as a textile fiber in knitwear and fleece coatings and it is rapidly closing in on other fibers as a component in wool blends for a variety of apparel uses. Recognizing the fact that dye research has given us an excellent range of cationic dyes for Orlon, it is nevertheless true that application research has been at least equally responsible for the phenomenal progress of this hydrophobic fiber. Likewise, excellent cooperation between mill personnel, chemist and application experts has spelled success for dyeing the various forms of Orlon—in tow, staple, package yarns, skeins and piece goods.

Orlon is not quite as dependent upon high temperatures for efficient dyeing as is Dacron, but temperature should be as close to 212°F as possible for best results in conventional equipment. In these applications the use of retarding agent (*25*) is strongly recommended to insure level dyeing with cationic dyes. Disperse colors can be used, however, without retarder, for light shades.

Temperatures above the boil (up to 230°F) are desirable because rate of diffusion is markedly increased, which means that dyeing cycles are shorter and staining of other fibers in blends is minimized.

In regard to continuous dyeing there is no application in commercial use today. However, a very promising pad-steam process for dyeing Orlon tow (*26*) has been developed on a laboratory scale. The procedure consists of padding a solution of cationic dyes with a swelling agent for the fiber and steaming at atmospheric pressure for five minutes.

Of the other acrylic fibers on the market Acrilan is the most important to our discussion. This fiber contains a basic modifier which provides affinity for anionic dyes. Acrilan also is dyeable with cationic and disperse colors. In the knitwear field the latter two classes of dyes are used to the greatest extent. In other uses anionic dyes, such as acid, premetallized acid and chrome dyes, are employed as well. It is interesting to note that blends of Acrilan and wool are dyeable with the same anionic dyes and the balance between the two fibers is controlled by means of a cationic transfer agent (*27, 28*).

Temperature plays the same role in dyeing Acrilan as it does with Orlon. Quite satisfactory results are obtainable at temperatures near the boil but similar advantages are available when dyeing at elevated temperatures.

OTHER FIBERS———High-temperature dyeing techniques apply as well to the triacetate fibers and, under certain conditions, to Dynel. They will probably apply also to Verel, Zefran, Creslan, Darlan and other new synthetic fibers which have not yet reached the market in commercial quantities.

Wool (*29*) and cotton (*30*) also are dyed at high temperatures above the boil. Wool rawstock, for example, can be dyed in considerably shorter time with chrome colors and acid dyes. There is also a considerable amount of evidence that improved transfer and levelling of dyes are obtained at high temperatures. Cotton dyed with direct colors and selected vat dyes in the range 220—260°F exhibit improved levelling and penetration. In the case of vat dyes, some advocate pigmentation of cellulosic fibers at high temperatures, followed by cooling to conventional reduction temperatures in order to avoid degradation of leuco vat dyes (*31*). Although there are several dyes which in the reduced state are unstable at high temperatures (220—260°F), a select number of vat dyes are sufficiently stable to give a good range of shades (*32*). These are applied with a pigmentation step at any desired temperature followed by reduction and dyeing at temperatures in the range of 220—250°F.

SUMMARY

Modern textile dyeing techniques have been developed in keeping with the demands of the consumer for low-cost, high-quality merchandise and the demands created by the ever expanding chemical industry which produces new dyes and new textile fibers.

The mass volume fiber, cotton, and its close relative, rayon, are now dyed by economical, continuous processes with vat dyes which provide the best possible fastness properties over the entire range of shades. The importance of these modern methods is appreciated when one considers the current trend toward fabrics and garments with the so-called "wash-'n-wear" properties. Continuous processes must be employed to hold costs in line particularly in the dyeing of blends such as the 65/35 combination of Dacron polyester fiber and cotton. Good fastness to commercial and home laundering is required despite the fact that the "wash-'n-wear" fabrics can be washed by hand. As far as the cellulosic portion is concerned, only the vat dyes will completely satisfy the top fastness requirements. Fortunately, the new synthetic fibers are also dyeable in a wide range of shades having very good fastness to light and washing.

This period in history will be remembered for the many changes and improvements in technology of dyeing by continuous methods of all forms of fibers, both natural and synthetic, the development and application of new classes of dyes and radically new departures in the coloration of the synthetic fibers. The use of carriers, transfer agents and high-temperature dyeing techniques are

all novel approaches which the textile mills and dyehouses have attacked with unparalleled vigor and resourcefulness. Everyone in the industry can be justly proud of these accomplishments.

As President Eisenhower stated during the recent political convention, "we must not look backward but forward to the demanding future." Further improvements must be made to raise still higher the quality of dyeing and, at the same time, lower costs. Research work in every phase of dyeing is needed to clarify the mechanism of each operation so that progress can be made through better understanding of the chemical and physical principles involved.

We are confident that continued cooperation between chemical manufacturers, engineers, textile mills and dye application experts will accomplish these objectives.

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RHODE ISLAND SECTION MEETING PHOTOS

DECEMBER 6, 1956

ANNUAL MEETING

Johnson's Hummocks Grille

Providence, RI

JANUARY 31, 1957

Johnson's Hummocks Grille

Providence, RI

(Photos courtesy of Ken Everett and John Trezise)

(Additional photos on page P256)

Abstracts

The Disperse Dyes: Their Development and Application. (Mercer Lecture)

Fourness, R K, *J Soc Dyers & Col* **72**, 513-27, November, 1956.

The disperse dyes, by definition of the S D C, are "a class of water-insoluble dyes originally introduced for dyeing cellulose acetate, and usually applied from fine aqueous suspensions."

The first disperse dyes on the market (the SRA dyes) were brought out by British Celanese in 1923. They were fine aqueous suspensions of water-insoluble azo and diphenylamine dyes, dispersed by sulforicinoleic acid (hence the "SRA" initials). The British Dyestuff Corp. soon introduced the Duranol dyes, which were dispersed aminoanthraquinone compounds. Other types followed, until today many ranges are available to the dyer.

These dyes constitute the first type to be applied directly to a fiber from an insoluble suspension. The author discusses the principle of the dispersion process, and stresses the importance of small particle size. Various methods of reducing the particle size are described.

The mechanism of the dyeing operation has been studied by numerous investigators. The original theory that the dyeing process was a case of "solid solution" in the fiber was disputed by other workers who considered it one of "adsorption from true solution". It has been suggested by one group that the dye slips, molecule by molecule, through narrow pores in the fiber structure and attaches itself possibly by means of non-polar Van der Waals forces. Still another theory assumes an attachment by hydrogen bonding of the dye to the —CO— groups in acetate and the polyesters, and possibly the —NH— groups in nylon.

The author points out that the manner in which a disperse dye dyes under a given set of conditions varies from one fiber to another. He describes various ways of speeding up the exhaustion of the dye on such fibers as Terylene (eg, by increasing the temperature or by the use of "carriers").

In discussing the behavior of mixtures of disperse dyes, he calls attention to the effect that one dye may have on the dyeing properties of another, and urges care in the selection of the components of a mixture.

He describes the chemistry of some of the disperse dyes, showing how the shade changes as different groups are added to the molecule. Regarding the connection between dyeing and fastness properties on the one hand and chemical constitution on the other, he states that "the dyes with superior fastness characteristics are also those whose application by hitherto conventional methods is the least satisfactory."

In addition to acetate, the author also describes at some length the application of disperse dyes to polyamide and polyester fibers, triacetate, and the acrylics. It is pointed out that the fastness of a particular dye is not necessarily the same on different fibers. Thus, burnt gas fumes do not normally fade the sensitive blue dyes on nylon and Terylene; some dyes on nylon have poor fastness to light compared with the same dyes on acetate; and the fastness of disperse dyes on wool is not good.

The author gives some attention to dyeing machines, particularly Du Pont's "Barotor" and the "Pad-Roll" process.

Sixty-four references to the literature are cited. —WHC

Faults in the Bleaching of Piecegoods

Anon, *Textile Recorder* **74**, 56-8, September, 1956.

At every stage of bleaching, including scouring, there are numerous opportunities for things to go wrong, with consequent ill effects on the cloth being processed.

Tendering of the goods during singeing may occur if the warp size contains magnesium chloride, even in small amounts.

Vat-dyed yarns in the cloth may bleed during the kier boil, particularly if the warp size contains starch. Replacement of a part of the caustic soda with soda ash, and the addition of mild oxidizing agents, are suggested to lessen the damage of bleeding, and the vat dyes should be carefully selected. The bleach bath should be as mild as possible.

Rub-marks may be caused by movement of the cloth against the side of the kier, and will show badly if the fabric is later dyed. Suggested remedies are loading the kier to capacity and lining the sides with cloth.

Rope marks are sometimes produced if tight-strand fast washing machines are used. To avoid this danger, a slack washing machine with adjustable bowls is recommended.

In continuous bleaching, the writer recommends automatic control of the steam in the J-box, to avoid waste of steam and damage to the peroxide. He also discusses the use of optical bleaching agents, but cautions against using too much. Choice must be made of the most suitable one for a particular purpose, since the fluorescence of the different brands varies from violet to greenish blue. The poor lightfastness of these products is stressed.

Tendering of the fabric may also be due to air in the kier, excessive oxidation in the bleach bath (eg, caused by catalytic decomposition of the peroxide by contact with iron or copper), or acid left in the goods by faulty washing.

The writer also discusses the bleaching of silk and part-silk hosiery, using peroxide. He recommends adding sodium silicate to the bleach bath until it tests just slightly alkaline to red litmus paper. If brown spots appear, they may be removed by washing thoroughly with warm water, souring with sulfuric acid, and soaping.—WHC

The Dyeing of New Yarns and Fabrics

Walls, IMS, *J Textile Institute* **47**, P724-31, August, 1956.

The speaker, in referring to the new yarns now being produced (high-bulk, textured, etc), pointed out that many of the novel effects achieved with these new materials result from the intelligent use of certain properties inherent in the synthetic fibers.

He said that the many virtues generally associated with these fibers are well known, and such properties as their strength, resistance to abrasion and rapid-dyeing qualities naturally make them very suitable for many of the new fabrics. More important, many of the new yarns could never have been produced but for one special property which most of the synthetic fibers possess, ie, thermoplasticity. This enables fabrics to be heat-set and thus stabilized in a desired form so that they become more crease-resistant and may have fancy effects incorporated in them; and it also enables twist or crimp to be set in yarns, features which are utilized to the full in many of the new stretch or bulk yarns. Fibers of this type now being used in these yarns include polymide fibers such as nylon, polyester fibers such as Terylene, and acrylic fibers such as Orlon and Acrilan. The new cellulose triacetate fibers, such as Courpleta and Tricel, have not yet appeared in novel yarns, but they may well do so before long, since they resemble the synthetic

fibers both in dyeing properties and in some fiber properties, notably thermoplasticity.

The various synthetic fibers can be dyed with different classes of dyes, but they differ from the natural fibers in that the classes of dyes that can be applied to any one fiber are very restricted; eg, Terylene and triacetate are today dyed only with disperse or azoic dyes, and Orlon mainly with disperse or basic dyes. Only with nylon and Acrilan is there a choice of several types of dyes. These restrictions naturally limit the range of wet-fastness properties that can be achieved.

The speaker described the application of dyes to the new fibers, pointing out that as the fibers are hydrophobic, they do not swell to any considerable extent in the dyebath, and dye molecules have difficulty in penetrating into them. The rate of diffusion can be accelerated by raising the dyeing temperature. In fact, large amounts of Terylene loose stock, slubbing and yarn are now being dyed at 120-130°C, he said. He also mentioned the addition of carriers to the dyebath to increase the rate of absorption.

Full instructions are given for dyeing the bulked, textured and stretch yarns, with particular emphasis on the precautions that must be taken during the dyeing process in order to maintain the novel effects that have been inserted in the goods.—WHC

Some New Advances Reported in Rayon and Man-made Fibers

Davis, L G, *Can Textile J* **73**, 45-8, November 30, 1956.

The writer reviews the "highlights" of an all-day conference on "Man-made Fiber Progress" sponsored by the NY Academy of Sciences on October 12, 1956.

John A Howsmom, discussing cellulose and cellulose acetate fibers, pointed out that rayon is a fiber in its own right, unlike any other fiber, and by utilizing recent technological advances such as crimpability and solution dyeing, it can be adapted for a wide variety of new uses. He mentioned particularly improvements in spinning which have imparted increased tensile strength and dimensional stability, and chemical modification resulting in still stronger, tougher fibers. He described the production of "crimpable" rayon fibers.

W W Heckert stated that recent research in polyamide and polyester fibers has emphasized their esthetic qualities and studied possible new end-uses. He described the process of manufacture of Taslan textured yarns. He stated that according to a recent discovery, if a Dacron fabric is treated with a 3% caustic soda solution at the boil for 90 minutes, it loses 15% by weight but feels much softer and more lively; also, a combination of calendering, heat-setting under relaxed conditions, and caustic treatment will impart an attractive hand to Dacron fabrics. The speaker also discussed the pilling problem, and suggested a possible remedy (vigorous brushing of the fabric, followed by shearing).

Frank J Soday, reporting on advances in the acrylic and vinyl fiber field, described research work on blends of different polymers (eg, polyacrylonitrile and cellulose acetate), producing unexpected results, particularly in the physical properties of the fibers subsequently obtained. There seems to be no end to the number of fibers that can be made by such blends, he said. He mentioned particularly the so-called "isotactic" polymers, made from simple olefines such as ethylene and propylene, from which very strong, high-melting fibers can be made from relatively cheap raw materials. It has been found that if acrylic and vinyl fibers are exposed to certain radiations under carefully controlled conditions, they develop improved thermal resistance and strength. The speaker expressed the opinion that wool as a textile fiber is "doomed". He predicted a bright future for the acrylic fibers.

M H Gurley, discussing bulk and stretch yarns, stated that in addition to their use in hosiery and other knitwear items, they should find employment in broad woven fabrics and carpets when their properties of stability, strength and durability become better known.—WHC

• PATENT DIGEST •

PAUL WENGRAF

WATER-REPELLENT TREATMENT———Quaternized Condensates of Chloromethyl Acetamides and High Nitriles G,2,02

USPat 2,750,306 (Crown Chem Corp——Pingree, Stevens——June 12, 1956)

The preamble to this patent discusses the methods for water repellency known by the tradenames Velan or Zelane, which are covered by Brit Pat 477,991 (Evans et al) and USPat 2,250,930 (see references below). The products are essentially composed of high alkylamido groups linked by a CH_2 group to a quaternary compound, such as stearamidomethyl pyridinium chloride and similar compounds. It is claimed that they do not confer a high degree of durable water repellency nor do the effects withstand laundering or drycleaning in a satisfactory way.

It is stated, in the current patent, that improved results in rendering the customary natural fibers and all man-made fibers (Vicara, Orlon, Dynel, etc) durably water repellent may be obtained by treating the goods with condensates of chloromethylated higher fatty amides with straight chain higher nitriles; the condensate is therefore quaternized by condensation with pyridine or another tertiary amine. These compounds are described further in the copending USPat 2,750,389 of the same date. Although no proof of the exact structure of these compounds has been established, it can be assumed that the chloromethyl acylamide with alkylnitrile forms an *iminochloride*, which is finally converted into a quaternary ammonium (or pyridinium) halide.

Example: Methylolstearamide, slurried with benzene, was transformed by passing H Cl gas into the stearamido methylchloride, which was condensed with octadecane nitrile (stearonitrile). The iminochloride so obtained was chloromethylated by reaction with paraformaldehyde and gaseous H Cl; finally pyridine was added while the temperature was maintained at 65-70°C. A white, water-dispersible paste resulted. Cloth impregnated with an aqueous dispersion of this condensate, dried at lower temperature, and baked for 90 sec at 155-150°C was found to exhibit superior water repellency and fastness to laundering and drycleaning.

References cited by the Patent Office:

USPat 2,250,930 (Imp Chem Ind/1941) refers to a special application of the Zelane (or Velan) process for treating animal (wool or silk) fibers.

Brit Pat 477,991 (Imp Chem Ind/1928) is the main patent that covers a method for the hydrophobing of cellulosic material with stearomethyl amidomethyl pyridinium chloride, followed by baking.

News of the Trade

TRI's 27th Annual Meeting

The raw materials which textile science and technology will be using in the years ahead to create new and exciting fibers for a multitude of end uses were discussed at the 27th Annual Meeting of Textile Research Institute of Princeton, N J, at the Hotel Commodore, March 14-15.

They were explained by Professor Herman Mark, Polytechnic Institute of Brooklyn, in his talk "Fiber-Forming Materials of the Future," which he delivered as guest luncheon speaker on the second day of the parley.

The program for the two-day conference, which attracted a record attendance, was arranged by Willard W McLeod, general chairman of the meeting and vice-president, Coats & Clark Research Laboratory, Newark, N J.

The Thursday morning and afternoon sessions had as chairman J B Goldberg, consultant to the textile and allied industries, who also served as moderator in question and answer sessions.

The entire day was devoted to a symposium on acrylic, vinyl, and dinitrile fibers.

Walter H Hindle, associate director of research, The Chemstrand Corp, opened with a talk on "Properties and Uses of Acrilan," after which C W Bendigo, technical director, American Cyanamid Co, gave a presentation on "Creslan." The morning closed with a talk by Richard D Smith, development supervisor, B F Goodrich Chemical Co, on "Darlan."

At lunch Sydney M Cone, Jr, president of TRI and vice-president, Cone Mills Corporation, traced "The State of the Institute."

The afternoon saw a resumption of the fiber symposium. A paper on "Dynel" was delivered by J M Swalm, Textile Development Department, Carbide & Carbon Chemicals Co; W J Heckert, assistant general director of sales, E I du Pont de Nemours & Co, Inc, gave a presentation on "Orlon"; Harry W Coover, Research Laboratories, Tennessee Eastman Co, spoke on "Verel," and G W Stanton, director of research, Textile Fiber Department, The Dow Chemical Company, covered "Zefran."

The program for Friday included the following presentations:

"TRI Research in 1956," John H Dillon, TRI director. A brief discussion of the research findings followed.

"Cotton Merchandising Changes to Conform with Modern Mill Requirements," Earl E Berkley, director, Fiber & Spinning Laboratory, Anderson, Clayton & Co.

"An Appraisal of Shrink-resistant Treatments for Wool," Arnold M Sookne, assistant director, Harris Research Laboratories.

"New Fibers in Tire Cord," Gerald Mallory, head, Cords and Fabrics Section, Research Division, Goodyear Tire & Rubber Co.

Chairman of the Friday morning program was W Hale Charch, research director, Pioneering Research Division, Textile Fibers Department, E I du Pont de Nemours & Co, Inc, and the afternoon chairman was George H Hotte, director, Fiber Sales and Service, National Aniline Division, Allied Chemical & Dye Corporation.

An array of new and improved textile testers and instruments augmented with displays by major fiber producers, dominated the exhibit area.

Feeley to Handle Zinsser Dyestuffs in NE and South

Zinsser & Company, Inc, Hastings-on-Hudson, N Y, subsidiary of the Harshaw Chemical Company, Cleveland, Ohio, has made arrangements with the E J Feeley Company to service its dyestuff customers in New England and the Southern States. Stocks will be carried by E J Feeley Company at the following points: 263 Summer Street, Boston, Mass; 1700 Walnut Street, Philadelphia, Pa; 650 State Street, Charlotte, N C.

Pfister Chemical to Manufacture Organic Intermediate Chemicals

A leading producer of naphthols, Pfister Chemicals Works, Ridgefield, NJ has announced its intention to manufacture an extensive line of organic intermediates. Recognizing the fact that, up to the present time, many intermediates are unavailable because of manufacturing restrictions. Pfister has set up facilities to produce a large list of intermediates in pilot plant or commercial quantities.

Pfister facilities are said to be among the most modern in the country. Specially designed reactors lined with materials such as nickel, glass, monel, stainless steel and alloys, insure the versatility required for the manufacture of the wide range of products that the company plans to undertake.

The types of intermediates that Pfister plans to make available in commercial or pilot plant quantities include: primary amines, acetoacet arylamides, nitro compounds, arylamides of cyclic acids, chlorinated compounds, carboxylic acids (including esters & acid chlorides), alkoxy compounds, pyrazolones, sulfonic acids (and salts), sulfonamides, and hydroxy compounds.

Millmaster Selling Glycerine

Millmaster Chemical Corporation, 295 Madison Avenue, New York, has undertaken the sale of glycerine as representative of the industrial chemical sales department of Lever Bros, New York.

Nelson S Knaggs (center), vice president in charge of sales, The Hilton-Davis Chemical Co, Cincinnati, chats with fellow guests of honor at 53rd annual meeting of Explorers' Club in New York. He is shown with Major Murray Wiener, USAF, (left) director of air operations for "Operation Deepfreeze" in Antarctica; and Captain Richard B Black, USNR, base operations officer of Task Force 43. Knaggs' movie "Nepal: Kingdom in The Sky", and latest films made at the South Pole in connection with the International Geophysical Year, were features of the affair.

1st Textile Market Research Conference Switched to N Y

The first market research conference on textiles, being sponsored by the National Cotton Council, will be held in New York, N Y, on May 28 and 29, and not in Washington, D C, as previously announced.

"Interest among top textile executives has become so widespread that it was decided to move the meeting to New York to enable a larger number of the textile leaders to participate," Frank McCord, the Council's market research director, said. The two-day session will be held at the Statler Hotel.

Mr McCord added that plans for the conference are rapidly taking shape and that details of the complete program will be announced shortly. The program is expected to point up: 1) that potentials for expanding textile consumption exist; 2) that available market research techniques can be employed to expand textile usage; and 3) that the real challenge to the US textile industry is to find ways and means of using these techniques and methods in the most effective way.

In addition to prominent speakers from the textile trade and allied interest groups, it is expected that the program will feature speakers from other industries which have successfully used market research in building consumer markets for their products.

GE Expanding Silicone Products Facilities

Construction of a new product and process development laboratory and further expansion of other facilities of the Silicone Products Department of the General Electric Co, has been announced by Charles E Reed, general manager.

Expected to be ready for occupancy in January, 1958, the laboratory is part of a $3,000,000 capital outlay planned for the Waterford, N Y, plant during 1957. More than $1,000,000 worth of additional facilities were added or nearly completed during 1956.

Dr Reed described the current expansion as part of a planned increase of all department facilities needed to study and manufacture silicone products to meet increasing industrial and consumer needs. An additional 69 acres of land adjacent to the original plant site was acquired during 1956 to provide space for future facilities.

The new, two-story research building will provide about double the space now available for laboratories and will be fully equipped for study of all aspects of silicone chemistry. Conceived as the first step in the creation of a silicone technical center, it will include complete library facilities as well as research equipment.

However, the General Electric Research Laboratory at The Knolls, Schenectady, will continue fundamental research in silicones.

Other 1957 construction will provide a significant increase in rubber compounding equipment and a substantial boost in manufacturing facilities for various silicone intermediates. Work will also continue on the expansion of various service and utility installations.

Nearing completion is a 16,000 square foot addition which will be used to augment existing facilities for the handling and storage of materials as well as to provide some additional office space.

A completely integrated silicone production unit, the Waterford plant manufactures basic chemical intermediates and silicone gums, rubbers, resins, fluids, emulsions, greases, and specialities. To meet still increasing needs of various industries, its capacity has been increased several times since the plant was started soon after World War II.

The General Electric silicone operation attained independent status as a full-fledged operating department in January, 1952, and is one of six departments in GE's Chemical & Metallurgical Division. In addition to being the center for manufacturing and research operations, the Waterford plant is also headquarters for national sales organization of the Silicone Products Department.

Emery Subsidiary Formed in Canada

Emery Industries, Inc. Cincinnati, has announced another major step in its expansion program with the formation of a wholly-owned subsidiary, Emery Industries (Canada) Ltd.

The new Canadian company acquired the land, buildings, manufacturing facilities and existing fatty acid business of S F Lawrason & Co, Ltd, of London, Ontario, on April 1. Lawrason has been a producer of fatty acids in Canada for over 75 years.

R T Hull, associated with Emery for many years in sales and product management, has been appointed vice president and general manager of Emery Industries (Canada) Ltd.

A sizeable investment is planned for expansion and modernization of present facilities. It is stated that installation of new equipment will enable Emery's Canadian branch to produce a complete line of fatty acids for the Canadian market equivalent to those currently supplied in the US.

In addition to the Emery brands of stearic, oleic, animal and vegetable fatty acids and glycerides, the new company will produce textile chemicals, lard oils, metal working compounds, and Sanitone drycleaning compounds.

F S Lawrason & Co, Ltd, under the direction of Walter J Evans, president, will be retained as exclusive sales agents for all Emery products, except Sanitone, in the Dominion. A joint program is planned which will enable Lawrason to provide complete technical sales and service assistance to Canadian consumers of Emery products.

The Lawrason Company is planning new quarters in London for expanded manufacture of its sanitary and specialty chemicals, along with its increased sales activities.

New USDA Research Project

Research aimed at developing cotton fabrics with added luster and smoothness has been initiated recently under a contract between the US Department of Agriculture's Southern Utilization Research and Development Division, New Orleans, La, and the North Carolina State College School of Textiles at Raleigh.

This research project is part of USDA's broad program to expand use of cotton through development of new and better cotton products. New cotton fabrics that are smooth, soft, and lustrous, without being stiff, should be more suitable than present cottons for a number of purposes. They could be used, for example, in linings, undergarments, and soft street dresses.

Researchers hope to find an inexpensive practical process to produce the desired type of cotton. In the course of their work, cotton fabrics will be impregnated with thermosetting and thermoplastic resins, chemical modifiers, and swelling agents. These chemical treatments will be combined with mechanical treatments. Tests are planned to evaluate the ability of treated fabrics to withstand such normal wet-processing operations as bleaching, dyeing, and laundering. Fabrics will also be tested for frictional properties, draping quality, breaking strength, and tear and acid resistances.

Project leader at North Carolina State College will be Prof Henry A Rutherford. W Norbert Berard will supervise the work for the Southern Utilization Research and Development Division.

Velveray Celebrating 20th Anniversary in Passaic

The Velveray Corporation, currently celebrating its 20th anniversary in Passaic, New Jersey, and its 39th year in the state, has disclosed plans to expand and diversify its production this year towards a total increase of at least 30% in the next three years.

The expansion announcement was made by Raymond L Schwartz, president of Velveray, as part of the first in a series of 20th Anniversary Passaic plant tours and luncheons to be conducted for industrial and community leaders and members of the press.

Velveray, considered to be the nation's largest flocking processor, moved its mill to Passaic in 1937. The mill had previously been located in Paterson, since 1918. The Company owns another extensive plant in Fall River, Mass. The present Passaic mill occupies over 100,000 square feet on Brighton and Walnut Streets in the old Brighton Mills building, on either side of the Passaic-Clifton borderline.

The avowed purpose of the Passaic plant tours is to reaffirm the company's "faith in the future" of the area and of the textile industry by acquainting manufacturers and community leaders with the new Velveray products and processes. These include Velvetex vinyl fabric wall covering, Nyvel vinyl-nylon tarpaulin, and new processes for flocking and printing all kinds of fabric.

"The American textile industry must become more flexible to withstand the economic 'rock and roll' of foreign competition and domestic demands," Mr Schwartz told visitors at the first 20th Anniversary plant tour. "Though Velveray is in textiles to stay, we are diversifying with related products to ensure continued progress." He went on to say that the company has purchased new machinery to develop its Passaic facilities.

Mr Schwartz demonstrated the Passaic plant's "broad range of production capabilities" by showing visitors the many different steps required in the production of Velvetex wall covering. Guests saw how the Velvetex cotton backing is treated with an antimildew agent. Then, the backing is fused with Ultron vinyl sheeting, developed for Velveray by the Monsanto Chemical Company. The cotton backing and the vinyl sheeting are fused by a combination of chemical adhesive and electronic heat.

The Passaic mill also prints the Velvetex wall covering in a wide range of decorative colors and designs. A group of Velvetex styles are embossed with textures which give a three-dimensional appearance. To make the wall covering completely scrubbable and fade-proof, only vinyl pigments are used for printing, which makes the design an integral part of the base vinyl plastic material. Cut in standard wall covering rolls, the Velvetex is packed and shipped from Passaic to wholesale distributors throughout the country franchised to sell the product to local dealers.

Another product manufactured at Velveray's Passaic mill, Nyvel vinyl and nylon sheeting, is used extensively as a waterproof tarpaulin and as upholstery for outdoor furniture. Nyvel, unlike canvas, does not absorb water and remains extremely lightweight for easy handling.

In its flocking and printing services to the textile industry, Velveray has created scores of different processes by which fabrics are decorated with raised, three-dimensional designs composed of flock (microscopic textile fibers which adhere to the cloth). The company recently developed an improved electrostatic flocking process which gives a high-pile cut-velvet effect. New processes for printing on glass cloth are being introduced by Velveray.

The Company, which reportedly processes over 60 million yards in its mills annually, maintains a complete laboratory for testing all its products made in Passaic. The laboratory contains such test equipment as the Fade-Ometer, the Scott tensile-strength tester, the Launder-Ometer, and the Wyzenbeck Abrasion tester.

Trustees Considering Name Change for PTI

The principal matter discussed at a meeting recently by the board of trustees of the Philadelphia Textile Institute concerned the changing of the name of the college to the Philadelphia College of Technology.

The question was raised as to whether or not the scope of the courses at the Institute should be broadened and the name changed following the trend of several other textile colleges.

It is felt by some that a more diversified curriculum will open the doors to a greater number of applicants and the emphasis in the curriculum should be placed on generalized engineering.

WALTER E HADLEY, FIRST AATCC SECRETARY

WALTER E Hadley, 76, a charter member and first national secretary of the American Association of Textile Chemists and Colorists, died March 7 in a hospital at Peterborough, NH. Mr Hadley had been a resident of Hancock, NH, since his retirement in 1944.

Mr Hadley was elected to honorary membership in the AATCC in 1949, in tribute to his service for seven years as AATCC secretary, as well as in other posts, during the Association's earlier years.

Born in Lowell, Mass, Mr Hadley attended Lowell High School, and Lowell Textile Institute, now known as Lowell Technological Institute. He taught at LTI for four years (1908-1912) as an instructor in the Chemistry and Dyeing Department.

Following his period as instructor at LTI, Mr Hadley became a research chemist with The Roessler and Hasslacher Chemical Co, Perth Amboy, NJ. where he remained four years. He then joined Clark Thread Co, Newark, NJ, as chief chemist, and during his employment with Clark became active in AATCC circles.

In 1934 he joined Standard-Coosa-Thatcher, Chattanooga, as superintendent of dyeing, bleaching and mercerizing, and remained there until his retirement.

He was very active in the Highland Congregational Church in Lowell, and had many friends in that area. He was well-known for his hobby, woodcarving, and was also vice-president of the Hancock, NH, Historical Society.

He is survived by his wife, Cora (Pinkerton) Hadley; a son, Richard P, an attorney, of New York; a daughter, Dr Elinor E, also New York; a sister, Mrs Grace Byam: and three grandchildren.

• NEW PRODUCTS AND DEVELOPMENTS •

Nalan RF

The addition of Nalan RF to Du Pont's line of durable water repellents and softeners was announced recently by the company's Dyes and Chemicals Division.

It is claimed that good wash and wear performance of fabrics can usually be improved still further by co-application of Nalan RF with Zeset S fabric stabilizer or Panalon CR concentrate resin finish and should be employed at a concentration of two to five percent, depending on the type of hand required on the fabric.

Nalan RF is said to be excellent as a softener and modifier for wash and wear finishes for cotton.

Depco Retarder N

The De Paul Chemical Co, 44-27 Purvis St, Long Island City, NY, has announced the development of its new retarder, Depco Retarder N for use with the new, "more dyeable" Orlon.

Depco Retarder N is designed for use with the basic or cationic dyestuffs. It reportedly prevents too rapid exhaustion of the dyestuff, thereby preventing streaked or shaded lots. A quaternary ammonium compound, Depco Retarder N in its physical form is an amber liquid, which is said to possess excellent stability and solubility properties.

Amounts of Depco Retarder N required varies with the depth of shade wanted or the percentage of dyestuffs used.

Further information may be obtained by writing to the De Paul Chemical Co.

Hartex Retarder A

Hart products Corp, 1440 Broadway, New York, NY, has announced the development of Hartex Retarder A, a dyeing auxiliary which is said to yield level light-shade dyeings on Orlon with cationic dyes. It functions by competing with the dyes for the reactive sites on the Orlon fiber, thereby allowing a slow, controlled and level dyeing to take place.

Hartex Retarder A is available as a readily-soluble liquid. Samples and technical data sheets will be sent by the manufacturer upon request.

Eastman Polyester Yellow RL; Dark Red FL

Two new dyes, Eastman Polyester Yellow RL and Eastman Polyester Dark Red FL, have been added to its series of dyes for polyester fibers by Eastman Chemical Products, Inc, subsidiary of Eastman Kodak Company. The addition of these colors brings the total number of dyes in this series to 12. A number of other new polyester dyes is in the process of development and their announcement is expected in the near future.

According to recently completed tests made in its development laboratories in Kingsport, Tennessee, the two new dyes reportedly possess the following characteristics:

Eastman Polyester Yellow RL produces economical, level shades of bright golden yellow on polyester fibers with very good fastness to light, washing and sublimation. The new polyester yellow may be applied at the boil with a carrier or under pressure. With selected carriers, good union dyeings may be obtained in fabrics containing polyester and triacetate fibers.

Eastman Polyester Dark Red FL is a maroon dye particularly suitable for economically achieving dark wine, bordeaux, brown and rubine shades on polyester fibers. In such heavy shades it possesses outstanding fastness to washing, drycleaning, perspiration and sublimation and very good fastness to light. The new dye may be applied at the boil with carriers or under pressure. While certain type carrying agents, such as the phenyl phenols, affect its light fastness, this property can be restored by heat treatment following dyeing. Fabrics containing polyester and triacetate fibers can be union dyed with the new dark red dye by the use of selected carriers.

In addition to the two new dyes, Eastman has also announced a significant improvement in its Polyester Red 2G introduced last August. This improvement is expected to affect a considerable economic advantage to those using it.

The newly improved Eastman Polyester Red 2G is described as dyeing polyester fibers a bright yellowish shade of red with very good fastness to light, washing, dry cleaning and sublimation. Applied at the boil with carriers or under pressure, Polyester Red 2G is an excellent, low-cost, red component in medium and dark combination shades with Eastman Polyester Blue 3RL Yellow RL and Blue GLF. While certain carrying agents such as the phenyl phenols affect the light fastness of the improved red, this property can be restored by applying a heat treatment after dyeing.

General Calendar

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
Gordon Research Conference on Textiles, July 8-12, Colby Jr College, New London, NH

AMERICAN OIL CHEMISTS SOCIETY
Spring, 1957 (Spring meeting, New Orleans); Sept 30-Oct 2, 1957 (Fall meeting, Cincinnati); Apr 21-23, 1958 (Memphis); Oct 20-22, 1958 (Chicago); Spring, 1959 (New Orleans); Fall, 1959 (Los Angeles).

AMERICAN MATERIAL HANDLING SOCIETY
Apr 29-May 3 (7th Materials Handling Exposition, Convention Hall, Philadelphia, Pa)

THE DRYSALTERS CLUB OF NEW ENGLAND
Apr 26 (Hotel Vendome, Boston); June 21 (Annual Outing—Wachusett Country Club, West Boylston, Mass).

THE FIBER SOCIETY
Spring Meeting—May 1-2, 1957, The Clemson House, Clemson S C; Sept 4-6 (Joint meeting with the Textile Institute—Hotel Statler, Boston, Mass)

LOWELL TECHNOLOGICAL INSTITUTE ALUMNI ASSOCIATION
Annual Reunion—May 18 (Lowell and Andover, Mass)

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS
NATIONAL KNITTED OUTERWEAR ASSOCIATION
UNDERWEAR INSTITUTE
April 29-May 3 (1957 Knitting Arts Exhibition, Atlantic City, NJ)

NATIONAL COTTON COUNCIL OF AMERICA
October 2-3 (Chemical Finishing Conference—Statler Hotel, Washington, DC)

PHI PSI FRATERNITY
April 25-27—Annual meeting, New Bedford Hotel, New Bedford, Mass.

PHILADELPHIA TEXTILE INSTITUTE ALUMNI ASSOCIATION
June 6-8 (Alumni Day, Alumni Outing, PTI Commencement)

PURDUE UNIVERSITY
May 13-15 (12th Purdue Industrial Waste Conference, Purdue Univ, Lafayette, Ind)

SYNTHETIC ORGANIC CHEMICAL MANUFACTURERS ASSOCIATION OF THE UNITED STATES
May 26-28 (Annual Outing Skytop, Pa); June 11, Sept 10, Oct 8, Nov 12 (Palm Terrace Suite, Hotel Roosevelt, New York, NY)

• NAMES IN THE NEWS •

Moister

Starkey

Mayer

Dickison

Liberti

Beggs

Bolander

The Michigan Alkali Division of Wyandotte Chemicals Corporation has established two new sales offices in the South—the Southeastern District Office at 46 - 5th Street, NE, Atlanta 5, Ga, and the Southwestern District Office at 304 National Bank Building, Baton Rouge, La.

In making the announcement, S B Scott, director of sales for the Division, said the building of new plants at Geismar, La vastly increases Wyandotte's sales territory, making more concentrated coverage of the area necessary.

Appointed managers of the new offices were **Roger Moister** for the Southeastern District and **Scott Starkey** for the Southwestern District.

David B Bolander was named resident salesman for the Southwestern District and will reside and operate out of Houston, Texas.

Each of the men assigned to the new offices has been with Wyandotte for a number of years, Mr Moister and Mr Starkey in the territories covered by the new districts and Mr Bolander in the Central District at Wyandotte.

Paul W Hatch has been named to the sales force of the organic chemicals division, Dewey and Almy Chemical Company Division of W R Grace & Co.

Formerly with Dickie-Raymond, Inc, Boston direct mail agency, Hatch has a wide background in direct mail and sales.

Market development of newly established products intended for use by industries outside the textile field will be among the new duties allotted to **Alan F Mayer,** salesman for Arnold, Hoffman & Co, Inc. **Bruce O Dickison** will take over the duties hitherto carried on by Mr Mayer.

For the past six years, Mr Mayer has been an Ahco sales representative, serving the midwestern states. In addition to Ahco's nontextile products, he will handle nontextile products of Imperial Chemical Industries Ltd, England, of which Arnold, Hoffman is an affiliate. Mr Mayer will be based at the Ahco headquarters in Providence, RI.

Mr Dickison has recently served as a sales representative in Southern New England, after nearly five years as a chemist in Ahco's Technical Service Labs. He will be attached to the company's Northern Sales Office in Teterboro, NJ, and will operate in the midwestern area.

OBITUARY

JOHNNES K PETSCHOW

FUNERAL services were held recently at the Home for Service, 56 Park Street, Montclair, NJ, for Johnnes K Petschow, 59, chief chemist for Royce Chemical Co, Carlton Hill, NJ. Mr Petschow died at his home in Glen Ridge, NJ, following a long illness.

Mr Petschow came to the United States 36 years ago from Germany. He had been with Royce Chemical Co since that time. He was a member of the American Association of Textile Chemists and Colorists and the American Chemical Society.

He is survived by his widow, Johnna; a daughter, Mrs Gilmer Fitchett; and a son, Kurt.

Pillsbury

John D Beggs, sales manager of National Starch Products Inc's Resin Division, has moved to Los Angeles and will continue to coordinate sales, technical and field efforts of this division from the Los Angeles office.

Before associateing with National, Mr Beggs was founder and president of Gelvatex Coatings Corporation, Anaheim, Calif, the first producers of commercial PVAc emulsion paints in the United States.

In coordination with Mr Beggs in this new arrangement, **Felix Liberti,** supervisor of the Resin Coating Laboratory at Plainfield, NJ, will be in charge of paint technical service work as well as long range paint research.

Metro-Atlantic, Inc has announced the appointment of **Charles H Pillsbury, Jr,** to its research staff in Centredale, RI. Mr Pillsbury will work under **Gerhard Sprenger,** director of research, in developing new products for the paper and leather industries.

Prior to his appointment with Metro-Atlantic, Inc, Mr Pillsbury was employed as plant chemist for Arnold, Hoffman & Co, Inc in Dighton, Mass, and later was in charge of analysis and formulation of products for textile and paper chemicals in their Providence laboratory.

TECHNICAL LITERATURE

(It is understood that the following literature is available from the sources listed in italics).

AHCOVEL X57 — *Arnold, Hoffman, & Co, Inc, Providence, RI*—Technical Bulletin No. 134 describes Ahcovel, a novel cationic softener. Termed by the makers a truly "universal" textile softener, Ahcovel X57 is said to perform effectively on cotton, viscose and acetate rayons, nylon, Orlon, Dacron, Darlan, etc, and to be of considerable merit in both pure and resin finishes.

The bulletin lists a wide variety of highly desirable characteristics attributed ot Ahcovel X57, including the fact that—whether used alone or as a plasticizer for resin finishes—it does not contribute to chlorine-retention damage.

Properties of Ahcovel X57, a pourable paste, and Ahcovel X57 Conc, a soft wax, are detailed as to color, pH, and density. Application characteristics and procedures for both forms of the new softener are summarized under the headings of dilution, compatibilities, stability, quantities necessary for application, use with optical bleaches, and performance. Under general description, it is noted that the Ahcovel X57 series show anti-static properties on the hydrophobic fibers, and are unique in their ability to confer anti-static properties to Darlan by substantive means.

CDS-97 — *Silicone Products Dept, General Electric Co, Waterford, NY* —This new 8-page illustrated catalog discusses more than 115 different applications for silicones, including textile finishes, antifoam agents, and water repellents.

It lists specialized literature covering product and application information as well as major G-E silicone products.

CH401—*Information Service, Jarrell-Ash Co, 26 Farwell St, Newtonville 60, Mass*—This highly informative new 28-page illustrated brochure describes the basic fundamentals of spectrochemical analysis, and includes a bibliography of reference material of value to spectrochemical analysts.

Written in easily understood language, this booklet outlines with interesting detail the methods, instruments and accessories encountered in all phases of spectrochemical analysis and includes examples of typical analytical problems, suggested laboratory floor plans, plus information on special purpose instruments.

It represents the first of a series of spectrochemical reference handbooks currently being prepared by Hilger & Watts Ltd, British instrument manufacturer, and will be distributed gratis in the United States by the Jarrell-Ash Co, exclusive US representatives for Hilger & Watts Ltd.

COPPER AND MANGANESE CONTENT OF SANDOZ DIRECT DYES—*Sandoz, Inc, 61-63 Van Dam St, New York 13, NY*—Data on the copper and manganese content of 401 Sandoz direct dyes are included in this booklet. The information should be of particular significance to dyers and finishers working with latex-treated textiles. The figures were determined by an independent analytical laboratory, and represent the copper and manganese contents of typical dyestuff lots.

LUBROL WX—*Arnold, Hoffman & Co, Inc, Providence, RI*—Lubrol WX, a nonionic surface-active agent, is detailed in AHCO Technical Bulletin No. 133.

Arnold, Hoffman states that Lubrol WX dissolves in water and produces clear solutions which are stable to acids, alkalis, salts and hard water. Emulsions of oleic acid formed with Lubrol WX, it is said, may be diluted to any desired degree without fear of breaking and, though very dilute emulsions may cream, they are readily redispersed on stirring.

The bulletin notes that Lubrol WX is particularly suitable for preparation of emulsions of red oil and of oleic acid-mineral oil mixtures, as used for the oiling of wool for spinning.

Application of an oleic acid emulsion prepared using Lubrol WX is described as extremely effective in removing graphite stains from fabrics prior to final processing. A method of aftertreatment of Dacron for static resistance is described, in which the fiber is treated by immersion or other suitable impregnation method with a room temperature solution of Lubrol WX and dried without rinsing.

REILLY CHEMICAL INDEX—*Reilly Tar & Chemical Corp, Merchants Bank Bldg, Indianapolis, Ind*—This brochure contains information on eight new compounds developed by Reilly during 1956.

The Chemical Index also contains a short description of all the chemicals produced by the company. They are listed alphabetically and according to classes. Many of these chemicals are available in commercial quantities. Those available on a limited basis will be produced commercially when demand warrants.

SAFETY WALL CHART ON CAUSTIC SODA—*Dept A, Solvay Process Div, Allied Chemical & Dye Corp, 61 Broadway, New York 6, NY*—This chart, written in nontechnical language, includes suggestions for protective clothing and equipment; rules and precautions to be followed in the unloading, handling and storage of caustic soda; first aid measures to be followed in the event of an accident; and instructions for safely thawing caustic soda in tank cars.

SYNTHRAPOL PWS—*Arnold, Hoffman & Co, Inc, Providence, RI*—Technical Bulletin No. 132 describes fully this nonionic surface-active agent. According to the makers, Synthrapol PWS was developed as a result of three years of research into the field of ethylene oxide condensates.

The number of industries deriving added benefits as a result of incorporating surface-active agents into their process, the bulletin points out, has increased consistently during the past decade. Broadly varied uses for Synthrapol PWS are suggested.

Wetting and rewetting properties of Synthrapol PWS are described in the bulletin, together with the effect of builders on its detergent value, and its good compatibility with other chemicals. Laboratory tests of the detergent properties of Synthrapol PWS on cotton and wool are reported, with illustrative graphs depicting relative degree of soil removal. Particular recommendations are given for its use in the paper field.

1957 KNITTING ARTS EXHIBITION

APRIL 29 - MAY 3

ATLANTIC CITY, NJ

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THE 1957 KNITTING ARTS EXHIBITION NUMBER OF AMERICAN DYESTUFF REPORTER WILL BE PUBLISHED APRIL 22

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